Appendix A

INTEC Tank Farm Facility Closure Supporting Tables and Photographs

Appendix A

INTEC Tank Farm Facility Closure Supporting Tables and Photographs

In support of the Tank Farm Facility (TFF) closure, inventory tables were generated for all tanks that have been cleaned up to this point; these tables are presented is Section A-1. Inventories at closure for all of the tanks that have been cleaned show that Tank WM-182 contains the highest Ci content. The inventory at closure for Tank WM-182 has been compared to the performance assessment (PA) single tank inventory in Section A-2 to show greater than expected removal of radioactivity in the tanks. Post-decontamination photos of the insides of the tanks are provided in Section A-3 to visually show the extent of the decontamination process. Fractions of the Class C concentration limits were calculated for the tanks, including the mass of the steel of the tanks and for the piping after grouting. Section A-4 presents alternative fraction of Class C concentration limits without including the mass of steel for the tanks and the mass of the grout for the piping.

A-1. POST-DECONTAMINATION RADIONUCLIDE INVENTORIES

Table A-1. Post-decontamination estimated inventory for Tank WM-103.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ac	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	4.02E–08	^{227}Ac	1.20E–09	6.28E–06	7.51E–15	3.22E–12	4.02E–08	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ac	1.73E–14	6.28E–06	1.08E–19	4.65E–17	5.81E–13	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	9.59E–12	^{108}Ag	2.85E–13	6.28E–06	1.79E–18	7.68E–16	9.59E–12	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	1.08E–10	^{108m}Ag	3.20E–12	6.28E–06	2.01E–17	8.63E–15	1.08E–10	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	8.00E–16	^{109m}Ag	2.38E–17	6.28E–06	1.49E–22	6.41E–20	8.01E–16	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	3.01E–17	^{110}Ag	8.93E–19	6.28E–06	5.61E–24	2.41E–21	3.01E–17	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	2.26E–15	^{110m}Ag	6.71E–17	6.28E–06	4.22E–22	1.81E–19	2.26E–15	0.00%
^{241}Am	[d]		3.40E–04	6.36E–03	^{241}Am	[e]		2.55E–11	1.09E–08	6.36E–03	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	2.40E–05	^{242}Am	7.13E–07	6.28E–06	4.48E–12	1.92E–09	2.40E–05	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	2.41E–05	^{242m}Am	7.17E–07	6.28E–06	4.50E–12	1.93E–09	2.41E–05	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	3.31E–05	^{243}Am	9.83E–07	6.28E–06	6.17E–12	2.65E–09	3.31E–05	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	1.89E–10	^{217}At	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%
^{137m}Ba	[d]		9.20E–01	1.72E+01	^{137m}Ba	[e]		6.28E–06	2.69E–03	1.72E+01	47.32%
^{10}Be	7.56E–11	1.8	1.36E–10	2.55E–09	^{10}Be	7.56E–11	6.28E–06	4.75E–16	2.04E–13	2.55E–09	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Bi	1.11E–10	6.28E–06	7.00E–16	3.00E–13	3.75E–09	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	1.82E–22	^{210m}Bi	5.41E–24	6.28E–06	3.40E–29	1.46E–26	1.82E–22	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Bi	1.20E–09	6.28E–06	7.52E–15	3.23E–12	4.03E–08	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Bi	7.18E–08	6.28E–06	4.51E–13	1.94E–10	2.42E–06	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	1.89E–10	^{213}Bi	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Bi	2.88E–10	6.28E–06	1.81E–15	7.75E–13	9.68E–09	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	7.41E–08	^{14}C	[e]		2.21E–10	9.48E–08	1.69E–07	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	8.00E–16	^{109}Cd	2.38E–17	6.28E–06	1.49E–22	6.41E–20	8.01E–16	0.00%

Table A-1. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{113m}Cd	5.78E–05	1.8	1.04E–04	1.95E–03	^{113m}Cd	5.78E–05	6.28E–06	3.63E–10	1.56E–07	1.95E–03	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	2.46E–08	^{142}Ce	7.31E–10	6.28E–06	4.59E–15	1.97E–12	2.46E–08	0.00%
^{144}Ce	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Ce	2.33E–10	6.28E–06	1.46E–15	6.27E–13	7.83E–09	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	2.43E–14	^{249}Cf	7.21E–16	6.28E–06	4.52E–21	1.94E–18	2.43E–14	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	1.26E–14	^{250}Cf	3.73E–16	6.28E–06	2.34E–21	1.00E–18	1.26E–14	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	3.85E–16	^{251}Cf	1.14E–17	6.28E–06	7.18E–23	3.08E–20	3.85E–16	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	1.63E–17	^{252}Cf	4.84E–19	6.28E–06	3.04E–24	1.30E–21	1.63E–17	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	1.99E–05	^{242}Cm	5.91E–07	6.28E–06	3.71E–12	1.59E–09	1.99E–05	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	4.33E–06	^{243}Cm	1.29E–07	6.28E–06	8.07E–13	3.46E–10	4.33E–06	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	2.37E–04	^{244}Cm	[e]		2.88E–12	1.24E–09	2.37E–04	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	5.66E–08	^{245}Cm	1.68E–09	6.28E–06	1.06E–14	4.53E–12	5.66E–08	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	3.71E–09	^{246}Cm	1.10E–10	6.28E–06	6.92E–16	2.97E–13	3.71E–09	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	4.11E–15	^{247}Cm	1.22E–16	6.28E–06	7.66E–22	3.29E–19	4.11E–15	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	4.34E–15	^{248}Cm	1.29E–16	6.28E–06	8.09E–22	3.47E–19	4.34E–15	0.00%
^{60}Co	[d]		5.02E–05	9.39E–04	^{60}Co	[e]		7.96E–10	3.41E–07	9.39E–04	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	1.02E–03	^{134}Cs	3.03E–05	6.28E–06	1.90E–10	8.17E–08	1.02E–03	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	4.84E–04	^{135}Cs	1.44E–05	6.28E–06	9.03E–11	3.87E–08	4.84E–04	0.00%
^{137}Cs	[d]		9.20E–01	1.72E+01	^{137}Cs	[e]		6.28E–06	2.69E–03	1.72E+01	47.48%
^{150}Eu	2.96E–10	1.8	5.34E–10	9.98E–09	^{150}Eu	2.96E–10	6.28E–06	1.86E–15	7.99E–13	9.98E–09	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	1.32E–03	^{152}Eu	3.92E–05	6.28E–06	2.46E–10	1.06E–07	1.32E–03	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	5.88E–02	^{154}Eu	[e]		3.57E–10	1.53E–07	5.88E–02	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	1.59E–02	^{155}Eu	4.74E–04	6.28E–06	2.97E–09	1.28E–06	1.59E–02	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	1.64E–02	^{55}Fe	4.88E–04	6.28E–06	3.07E–09	1.31E–06	1.64E–02	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	1.89E–10	^{221}Fr	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	5.55E–10	^{223}Fr	1.65E–11	6.28E–06	1.04E–16	4.44E–14	5.55E–10	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	1.20E–15	^{152}Gd	3.58E–17	6.28E–06	2.25E–22	9.64E–20	1.20E–15	0.00%

Table A-1. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{153}Gd	4.15E–19	1.8	7.48E–19	1.40E–17	^{153}Gd	4.15E–19	6.28E–06	2.61E–24	1.12E–21	1.40E–17	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	1.08E–02	^{3}H	[e]		2.48E–09	1.06E–06	1.08E–02	0.03%
^{166m}Ho	1.13E–09	1.8	2.03E–09	3.79E–08	^{166m}Ho	1.13E–09	6.28E–06	7.07E–15	3.03E–12	3.79E–08	0.00%
^{129}I	[d]		6.24E–07	1.17E–05	^{129}I	[e]		1.27E–10	5.45E–08	1.17E–05	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	9.26E–15	^{115}In	2.75E–16	6.28E–06	1.73E–21	7.41E–19	9.26E–15	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	1.58E–13	^{138}La	4.68E–15	6.28E–06	2.94E–20	1.26E–17	1.58E–13	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	2.94E–03	^{93m}Nb	8.74E–05	6.28E–06	5.49E–10	2.35E–07	2.94E–03	0.01%
^{94}Nb	[d]		1.66E–04	3.10E–03	^{94}Nb	[e]		4.28E–10	1.84E–07	3.10E–03	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	1.33E–12	^{144}Nd	3.96E–14	6.28E–06	2.49E–19	1.07E–16	1.33E–12	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	3.79E–04	^{59}Ni	1.13E–05	6.28E–06	7.08E–11	3.04E–08	3.79E–04	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	4.32E–02	^{63}Ni	[e]		3.70E–07	1.59E–04	4.33E–02	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	7.42E–09	^{236}Np	2.21E–10	6.28E–06	1.38E–15	5.94E–13	7.42E–09	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	7.10E–04	^{237}Np	[e]		1.86E–11	7.98E–09	7.10E–04	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	1.21E–07	^{238}Np	3.58E–09	6.28E–06	2.25E–14	9.66E–12	1.21E–07	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	3.31E–05	^{239}Np	9.83E–07	6.28E–06	6.17E–12	2.65E–09	3.31E–05	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	9.88E–13	^{240m}Np	2.94E–14	6.28E–06	1.84E–19	7.91E–17	9.88E–13	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	7.14E–08	^{231}Pa	2.12E–09	6.28E–06	1.33E–14	5.71E–12	7.14E–08	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	7.10E–04	^{233}Pa	2.11E–05	6.28E–06	1.33E–10	5.69E–08	7.10E–04	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	3.57E–08	^{234}Pa	1.06E–09	6.28E–06	6.67E–15	2.86E–12	3.57E–08	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	2.75E–05	^{234m}Pa	8.17E–07	6.28E–06	5.13E–12	2.20E–09	2.75E–05	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	1.89E–10	^{209}Pb	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Pb	1.11E–10	6.28E–06	7.00E–16	3.00E–13	3.75E–09	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Pb	1.20E–09	6.28E–06	7.52E–15	3.23E–12	4.03E–08	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Pb	7.18E–08	6.28E–06	4.51E–13	1.94E–10	2.42E–06	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Pb	2.88E–10	6.28E–06	1.81E–15	7.75E–13	9.68E–09	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	1.37E–05	^{107}Pd	4.06E–07	6.28E–06	2.55E–12	1.09E–09	1.37E–05	0.00%

Table A-1. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{146}Pm	4.00E–07	1.8	7.20E–07	1.35E–05	^{146}Pm	4.00E–07	6.28E–06	2.51E–12	1.08E–09	1.35E–05	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	1.31E–02	^{147}Pm	3.88E–04	6.28E–06	2.44E–09	1.05E–06	1.31E–02	0.04%
^{210}Po	1.08E–10	1.8	1.94E–10	3.62E–09	^{210}Po	1.08E–10	6.28E–06	6.76E–16	2.90E–13	3.62E–09	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	1.13E–10	^{211}Po	3.35E–12	6.28E–06	2.11E–17	9.03E–15	1.13E–10	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	1.55E–06	^{212}Po	4.60E–08	6.28E–06	2.89E–13	1.24E–10	1.55E–06	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	1.85E–10	^{213}Po	5.49E–12	6.28E–06	3.45E–17	1.48E–14	1.85E–10	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	9.68E–09	^{214}Po	2.87E–10	6.28E–06	1.81E–15	7.74E–13	9.68E–09	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	4.03E–08	^{215}Po	1.20E–09	6.28E–06	7.52E–15	3.23E–12	4.03E–08	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	2.42E–06	^{216}Po	7.18E–08	6.28E–06	4.51E–13	1.94E–10	2.42E–06	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	9.68E–09	^{218}Po	2.88E–10	6.28E–06	1.81E–15	7.75E–13	9.68E–09	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Pr	2.33E–10	6.28E–06	1.46E–15	6.27E–13	7.83E–09	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	9.40E–11	^{144m}Pr	2.79E–12	6.28E–06	1.75E–17	7.52E–15	9.40E–11	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	2.20E–07	^{236}Pu	6.52E–09	6.28E–06	4.10E–14	1.76E–11	2.20E–07	0.00%
^{238}Pu	[d]		9.23E–03	1.73E–01	^{238}Pu	[e]		3.79E–10	1.63E–07	1.73E–01	0.48%
^{239}Pu	[d]		2.75E–03	5.14E–02	^{239}Pu	[e]		2.90E–11	1.24E–08	5.14E–02	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	2.04E–02	^{240}Pu	6.06E–04	6.28E–06	3.81E–09	1.63E–06	2.04E–02	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	2.95E–01	^{241}Pu	[e]		4.40E–08	1.89E–05	2.95E–01	0.81%
^{242}Pu	4.43E–07	1.8	7.98E–07	1.49E–05	^{242}Pu	4.43E–07	6.28E–06	2.78E–12	1.19E–09	1.49E–05	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	4.11E–15	^{243}Pu	1.22E–16	6.28E–06	7.66E–22	3.29E–19	4.11E–15	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	9.90E–13	^{244}Pu	2.94E–14	6.28E–06	1.85E–19	7.92E–17	9.90E–13	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	4.03E–08	^{223}Ra	1.20E–09	6.28E–06	7.52E–15	3.23E–12	4.03E–08	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	2.42E–06	^{224}Ra	7.18E–08	6.28E–06	4.51E–13	1.94E–10	2.42E–06	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ra	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	9.68E–09	^{226}Ra	2.88E–10	6.28E–06	1.81E–15	7.75E–13	9.68E–09	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ra	1.73E–14	6.28E–06	1.08E–19	4.65E–17	5.81E–13	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	2.41E–08	^{87}Rb	7.15E–10	6.28E–06	4.49E–15	1.93E–12	2.41E–08	0.00%

Table A-1. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{102}Rh	2.46E–09	1.8	4.44E–09	8.29E–08	^{102}Rh	2.46E–09	6.28E–06	1.55E–14	6.64E–12	8.30E–08	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Rh	7.69E–09	6.28E–06	4.83E–14	2.07E–11	2.59E–07	0.00%
^{219}Rn	1.20E–09	1.8	2.16E–09	4.03E–08	^{219}Rn	1.20E–09	6.28E–06	7.52E–15	3.23E–12	4.03E–08	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	2.42E–06	^{220}Rn	7.18E–08	6.28E–06	4.51E–13	1.94E–10	2.42E–06	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	9.68E–09	^{222}Rn	2.88E–10	6.28E–06	1.81E–15	7.75E–13	9.68E–09	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Ru	7.69E–09	6.28E–06	4.83E–14	2.07E–11	2.59E–07	0.00%
^{125}Sb	[d]		5.55E–04	1.04E–02	^{125}Sb	[e]		2.55E–10	1.09E–07	1.04E–02	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	4.76E–05	^{126}Sb	1.41E–06	6.28E–06	8.88E–12	3.81E–09	4.76E–05	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	3.40E–04	^{126m}Sb	1.01E–05	6.28E–06	6.35E–11	2.72E–08	3.40E–04	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	3.61E–04	^{79}Se	1.07E–05	6.28E–06	6.74E–11	2.89E–08	3.61E–04	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	1.56E–10	^{146}Sm	4.65E–12	6.28E–06	2.92E–17	1.25E–14	1.56E–10	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	6.10E–09	^{147}Sm	1.81E–10	6.28E–06	1.14E–15	4.88E–13	6.10E–09	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	3.13E–14	^{148}Sm	9.30E–16	6.28E–06	5.84E–21	2.51E–18	3.13E–14	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	2.78E–15	^{149}Sm	8.26E–17	6.28E–06	5.19E–22	2.22E–19	2.78E–15	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	2.59E–01	^{151}Sm	7.71E–03	6.28E–06	4.84E–08	2.08E–05	2.59E–01	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	3.21E–13	^{119m}Sn	9.55E–15	6.28E–06	6.00E–20	2.57E–17	3.21E–13	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	1.93E–03	^{121m}Sn	5.74E–05	6.28E–06	3.60E–10	1.55E–07	1.93E–03	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	3.40E–04	^{126}Sn	1.01E–05	6.28E–06	6.35E–11	2.72E–08	3.40E–04	0.00%
^{90}Sr	[d]		1.87E–02	3.50E–01	^{90}Sr	[e]		2.78E–04	1.19E–01	4.69E–01	1.29%
^{98}Tc	6.34E–11	1.8	1.14E–10	2.14E–09	^{98}Tc	6.34E–11	6.28E–06	3.98E–16	1.71E–13	2.14E–09	0.00%
^{99}Tc	[d]		6.17E–04	1.15E–02	^{99}Tc	[e]		2.12E–08	9.09E–06	1.15E–02	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	1.72E–15	^{123}Te	5.12E–17	6.28E–06	3.22E–22	1.38E–19	1.72E–15	0.00%
^{125m}Te	1.43E–05		1.36E–04	2.54E–03	^{125m}Te	1.43E–05	6.28E–06	9.00E–11	3.86E–08	2.54E–03	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	3.98E–08	^{227}Th	1.18E–09	6.28E–06	7.42E–15	3.18E–12	3.98E–08	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	2.41E–06	^{228}Th	7.16E–08	6.28E–06	4.50E–13	1.93E–10	2.41E–06	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	1.89E–10	^{229}Th	5.61E–12	6.28E–06	3.52E–17	1.51E–14	1.89E–10	0.00%

Table A-1. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{230}Th	2.35E–08	1.8	4.24E–08	7.92E–07	^{230}Th	2.35E–08	6.28E–06	1.48E–13	6.34E–11	7.92E–07	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	2.67E–05	^{231}Th	7.93E–07	6.28E–06	4.98E–12	2.14E–09	2.67E–05	0.00%
^{232}Th	1.85E–14	1.8	3.33E–14	6.23E–13	^{232}Th	1.85E–14	6.28E–06	1.16E–19	4.98E–17	6.23E–13	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	2.75E–05	^{234}Th	8.17E–07	6.28E–06	5.13E–12	2.20E–09	2.75E–05	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	4.02E–08	^{207}Tl	1.19E–09	6.28E–06	7.50E–15	3.22E–12	4.02E–08	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	8.69E–07	^{208}Tl	2.58E–08	6.28E–06	1.62E–13	6.95E–11	8.69E–07	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	4.08E–12	^{209}Tl	1.21E–13	6.28E–06	7.61E–19	3.26E–16	4.08E–12	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	1.61E–14	^{171}Tm	4.80E–16	6.28E–06	3.01E–21	1.29E–18	1.61E–14	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	2.33E–06	^{232}U	6.91E–08	6.28E–06	4.34E–13	1.86E–10	2.33E–06	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	5.97E–08	^{233}U	1.77E–09	6.28E–06	1.11E–14	4.78E–12	5.97E–08	0.00%
^{234}U	[d]		2.98E–06	5.57E–05	^{234}U	[e]		7.28E–12	3.12E–09	5.57E–05	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	2.67E–05	^{235}U	7.93E–07	6.28E–06	4.98E–12	2.14E–09	2.67E–05	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	6.22E–05	^{236}U	1.85E–06	6.28E–06	1.16E–11	4.98E–09	6.22E–05	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	7.23E–06	^{237}U	2.15E–07	6.28E–06	1.35E–12	5.78E–10	7.23E–06	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	2.75E–05	^{238}U	8.17E–07	6.28E–06	5.13E–12	2.20E–09	2.75E–05	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	9.88E–13	^{240}U	2.94E–14	6.28E–06	1.84E–19	7.91E–17	9.88E–13	0.00%
^{90}Y	[d]		1.87E–02	3.50E–01	^{90}Y	8.88E–01	6.28E–06	5.579E–06	2.39E–03	3.52E–01	0.97%
^{93}Zr	1.06E–04	1.8	1.90E–04	3.56E–03	^{93}Zr	1.06E–04	6.28E–06	6.64E–10	2.85E–07	3.56E–03	0.01%
			Total	36.1				Total	0.2	36.4	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-103.

Table A-2. Post-decontamination estimated inventory for Tank WM-104.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ac	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	4.02E–08	^{227}Ac	1.20E–09	2.37E–05	2.83E–14	1.22E–11	4.02E–08	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ac	1.73E–14	2.37E–05	4.09E–19	1.76E–16	5.82E–13	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	9.59E–12	^{108}Ag	2.85E–13	2.37E–05	6.75E–18	2.90E–15	9.59E–12	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	1.08E–10	^{108m}Ag	3.20E–12	2.37E–05	7.59E–17	3.26E–14	1.08E–10	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	8.00E–16	^{109m}Ag	2.38E–17	2.37E–05	5.64E–22	2.42E–19	8.01E–16	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	3.01E–17	^{110}Ag	8.93E–19	2.37E–05	2.12E–23	9.08E–21	3.01E–17	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	2.26E–15	^{110m}Ag	6.71E–17	2.37E–05	1.59E–21	6.83E–19	2.26E–15	0.00%
^{241}Am	[d]		3.40E–04	6.36E–03	^{241}Am	[e]		5.86E–09	2.51E–06	6.36E–03	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	2.40E–05	^{242}Am	7.13E–07	2.37E–05	1.69E–11	7.25E–09	2.40E–05	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	2.41E–05	^{242m}Am	7.17E–07	2.37E–05	1.70E–11	7.29E–09	2.41E–05	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	3.31E–05	^{243}Am	9.83E–07	2.37E–05	2.33E–11	1.00E–08	3.31E–05	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	1.89E–10	^{217}At	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{137m}Ba	[d]		9.20E–01	1.72E+01	^{137m}Ba	[e]		2.37E–05	1.02E–02	1.72E+01	47.62%
^{10}Be	7.56E–11	1.8	1.36E–10	2.55E–09	^{10}Be	7.56E–11	2.37E–05	1.79E–15	7.69E–13	2.55E–09	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Bi	1.11E–10	2.37E–05	2.64E–15	1.13E–12	3.75E–09	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	1.82E–22	^{210m}Bi	5.41E–24	2.37E–05	1.28E–28	5.50E–26	1.82E–22	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Bi	1.20E–09	2.37E–05	2.84E–14	1.22E–11	4.03E–08	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Bi	7.18E–08	2.37E–05	1.70E–12	7.30E–10	2.42E–06	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	1.89E–10	^{213}Bi	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Bi	2.88E–10	2.37E–05	6.81E–15	2.92E–12	9.68E–09	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	7.41E–08	^{14}C	[e]		8.29E–11	3.56E–08	1.10E–07	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	8.00E–16	^{109}Cd	2.38E–17	2.37E–05	5.64E–22	2.42E–19	8.01E–16	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	1.95E–03	^{113m}Cd	5.78E–05	2.37E–05	1.37E–09	5.88E–07	1.95E–03	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	2.46E–08	^{142}Ce	7.31E–10	2.37E–05	1.73E–14	7.44E–12	2.46E–08	0.00%

Table A-2. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{144}Ce	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Ce	2.33E–10	2.37E–05	5.51E–15	2.37E–12	7.83E–09	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	2.43E–14	^{249}Cf	7.21E–16	2.37E–05	1.71E–20	7.33E–18	2.43E–14	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	1.26E–14	^{250}Cf	3.73E–16	2.37E–05	8.84E–21	3.79E–18	1.26E–14	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	3.85E–16	^{251}Cf	1.14E–17	2.37E–05	2.71E–22	1.16E–19	3.85E–16	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	1.63E–17	^{252}Cf	4.84E–19	2.37E–05	1.15E–23	4.92E–21	1.63E–17	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	1.99E–05	^{242}Cm	5.91E–07	2.37E–05	1.40E–11	6.01E–09	1.99E–05	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	4.33E–06	^{243}Cm	1.29E–07	2.37E–05	3.05E–12	1.31E–09	4.33E–06	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	2.37E–04	^{244}Cm	[e]		1.31E–21	5.62E–19	2.37E–04	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	5.66E–08	^{245}Cm	1.68E–09	2.37E–05	3.98E–14	1.71E–11	5.66E–08	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	3.71E–09	^{246}Cm	1.10E–10	2.37E–05	2.61E–15	1.12E–12	3.71E–09	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	4.11E–15	^{247}Cm	1.22E–16	2.37E–05	2.89E–21	1.24E–18	4.11E–15	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	4.34E–15	^{248}Cm	1.29E–16	2.37E–05	3.05E–21	1.31E–18	4.34E–15	0.00%
^{60}Co	[d]		5.02E–05	9.39E–04	^{60}Co	[e]		6.98E–09	2.99E–06	9.42E–04	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	1.02E–03	^{134}Cs	3.03E–05	2.37E–05	7.19E–10	3.08E–07	1.02E–03	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	4.84E–04	^{135}Cs	1.44E–05	2.37E–05	3.41E–10	1.46E–07	4.84E–04	0.00%
^{137}Cs	[d]		9.20E–01	1.72E+01	^{137}Cs	[e]		2.37E–05	1.02E–02	1.72E+01	47.62%
^{150}Eu	2.96E–10	1.8	5.34E–10	9.98E–09	^{150}Eu	2.96E–10	2.37E–05	7.03E–15	3.01E–12	9.98E–09	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	1.32E–03	^{152}Eu	3.92E–05	2.37E–05	9.29E–10	3.98E–07	1.32E–03	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	5.88E–02	^{154}Eu	[e]		8.79E–09	3.77E–06	5.88E–02	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	1.59E–02	^{155}Eu	4.74E–04	2.37E–05	1.12E–08	4.82E–06	1.59E–02	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	1.64E–02	^{55}Fe	4.88E–04	2.37E–05	1.16E–08	4.96E–06	1.64E–02	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	1.89E–10	^{221}Fr	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	5.55E–10	^{223}Fr	1.65E–11	2.37E–05	3.91E–16	1.68E–13	5.55E–10	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	1.20E–15	^{152}Gd	3.58E–17	2.37E–05	8.48E–22	3.64E–19	1.20E–15	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	1.40E–17	^{153}Gd	4.15E–19	2.37E–05	9.84E–24	4.22E–21	1.40E–17	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	1.08E–02	^{3}H	[e]		1.41E–08	6.05E–06	1.08E–02	0.03%

Table A-2. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{166m}Ho	1.13E–09	1.8	2.03E–09	3.79E–08	^{166m}Ho	1.13E–09	2.37E–05	2.67E–14	1.14E–11	3.79E–08	0.00%
^{129}I	[d]		6.24E–07	1.17E–05	^{129}I	[e]		1.36E–10	5.83E–08	1.17E–05	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	9.26E–15	^{115}In	2.75E–16	2.37E–05	6.52E–21	2.80E–18	9.26E–15	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	1.58E–13	^{138}La	4.68E–15	2.37E–05	1.11E–19	4.76E–17	1.58E–13	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	2.94E–03	^{93m}Nb	8.74E–05	2.37E–05	2.07E–09	8.88E–07	2.94E–03	0.01%
^{94}Nb	[d]		1.66E–04	3.10E–03	^{94}Nb	[e]		1.02E–08	4.38E–06	3.11E–03	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	1.33E–12	^{144}Nd	3.96E–14	2.37E–05	9.40E–19	4.03E–16	1.33E–12	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	3.79E–04	^{59}Ni	1.13E–05	2.37E–05	2.67E–10	1.15E–07	3.79E–04	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	4.32E–02	^{63}Ni	[e]		8.79E–09	3.77E–06	4.32E–02	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	7.42E–09	^{236}Np	2.21E–10	2.37E–05	5.23E–15	2.24E–12	7.42E–09	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	7.10E–04	^{237}Np	[e]		1.06E–10	4.55E–08	7.10E–04	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	1.21E–07	^{238}Np	3.58E–09	2.37E–05	8.50E–14	3.64E–11	1.21E–07	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	3.31E–05	^{239}Np	9.83E–07	2.37E–05	2.33E–11	1.00E–08	3.31E–05	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	9.88E–13	^{240m}Np	2.94E–14	2.37E–05	6.96E–19	2.99E–16	9.89E–13	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	7.14E–08	^{231}Pa	2.12E–09	2.37E–05	5.03E–14	2.16E–11	7.14E–08	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	7.10E–04	^{233}Pa	2.11E–05	2.37E–05	5.00E–10	2.15E–07	7.11E–04	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	3.57E–08	^{234}Pa	1.06E–09	2.37E–05	2.52E–14	1.08E–11	3.57E–08	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	2.75E–05	^{234m}Pa	8.17E–07	2.37E–05	1.94E–11	8.30E–09	2.75E–05	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	1.89E–10	^{209}Pb	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Pb	1.11E–10	2.37E–05	2.64E–15	1.13E–12	3.75E–09	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Pb	1.20E–09	2.37E–05	2.84E–14	1.22E–11	4.03E–08	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Pb	7.18E–08	2.37E–05	1.70E–12	7.30E–10	2.42E–06	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Pb	2.88E–10	2.37E–05	6.81E–15	2.92E–12	9.68E–09	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	1.37E–05	^{107}Pd	4.06E–07	2.37E–05	9.62E–12	4.13E–09	1.37E–05	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	1.35E–05	^{146}Pm	4.00E–07	2.37E–05	9.48E–12	4.07E–09	1.35E–05	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	1.31E–02	^{147}Pm	3.88E–04	2.37E–05	9.20E–09	3.95E–06	1.31E–02	0.04%

Table A-2. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{210}Po	1.08E–10	1.8	1.94E–10	3.62E–09	^{210}Po	1.08E–10	2.37E–05	2.55E–15	1.09E–12	3.62E–09	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	1.13E–10	^{211}Po	3.35E–12	2.37E–05	7.95E–17	3.41E–14	1.13E–10	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	1.55E–06	^{212}Po	4.60E–08	2.37E–05	1.09E–12	4.68E–10	1.55E–06	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	1.85E–10	^{213}Po	5.49E–12	2.37E–05	1.30E–16	5.58E–14	1.85E–10	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	9.68E–09	^{214}Po	2.87E–10	2.37E–05	6.81E–15	2.92E–12	9.68E–09	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	4.03E–08	^{215}Po	1.20E–09	2.37E–05	2.84E–14	1.22E–11	4.03E–08	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	2.42E–06	^{216}Po	7.18E–08	2.37E–05	1.70E–12	7.30E–10	2.42E–06	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	9.68E–09	^{218}Po	2.88E–10	2.37E–05	6.82E–15	2.92E–12	9.68E–09	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Pr	2.33E–10	2.37E–05	5.51E–15	2.37E–12	7.83E–09	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	9.40E–11	^{144m}Pr	2.79E–12	2.37E–05	6.62E–17	2.84E–14	9.40E–11	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	2.20E–07	^{236}Pu	6.52E–09	2.37E–05	1.55E–13	6.63E–11	2.20E–07	0.00%
^{238}Pu	[d]		9.23E–03	1.73E–01	^{238}Pu	[e]		2.30E–07	9.87E–05	1.73E–01	0.48%
^{239}Pu	[d]		2.75E–03	5.14E–02	^{239}Pu	[e]		2.87E–08	1.23E–05	5.14E–02	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	2.04E–02	^{240}Pu	6.06E–04	2.37E–05	1.44E–08	6.16E–06	2.04E–02	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	2.95E–01	^{241}Pu	[e]		1.10E–07	4.72E–05	2.95E–01	0.81%
^{242}Pu	4.43E–07	1.8	7.98E–07	1.49E–05	^{242}Pu	4.43E–07	2.37E–05	1.05E–11	4.51E–09	1.49E–05	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	4.11E–15	^{243}Pu	1.22E–16	2.37E–05	2.89E–21	1.24E–18	4.11E–15	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	9.90E–13	^{244}Pu	2.94E–14	2.37E–05	6.97E–19	2.99E–16	9.90E–13	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	4.03E–08	^{223}Ra	1.20E–09	2.37E–05	2.84E–14	1.22E–11	4.03E–08	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	2.42E–06	^{224}Ra	7.18E–08	2.37E–05	1.70E–12	7.30E–10	2.42E–06	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ra	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	9.68E–09	^{226}Ra	2.88E–10	2.37E–05	6.82E–15	2.92E–12	9.68E–09	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ra	1.73E–14	2.37E–05	4.09E–19	1.76E–16	5.82E–13	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	2.41E–08	^{87}Rb	7.15E–10	2.37E–05	1.69E–14	7.26E–12	2.41E–08	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	8.29E–08	^{102}Rh	2.46E–09	2.37E–05	5.84E–14	2.51E–11	8.30E–08	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Rh	7.69E–09	2.37E–05	1.82E–13	7.81E–11	2.59E–07	0.00%

Table A-2. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{219}Rn	1.20E–09	1.8	2.16E–09	4.03E–08	^{219}Rn	1.20E–09	2.37E–05	2.84E–14	1.22E–11	4.03E–08	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	2.42E–06	^{220}Rn	7.18E–08	2.37E–05	1.70E–12	7.30E–10	2.42E–06	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	9.68E–09	^{222}Rn	2.88E–10	2.37E–05	6.82E–15	2.92E–12	9.68E–09	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Ru	7.69E–09	2.37E–05	1.82E–13	7.81E–11	2.59E–07	0.00%
^{125}Sb	[d]		5.55E–04	1.04E–02	^{125}Sb	[e]		1.11E–08	4.76E–06	1.04E–02	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	4.76E–05	^{126}Sb	1.41E–06	2.37E–05	3.35E–11	1.44E–08	4.76E–05	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	3.40E–04	^{126m}Sb	1.01E–05	2.37E–05	2.39E–10	1.03E–07	3.40E–04	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	3.61E–04	^{79}Se	1.07E–05	2.37E–05	2.54E–10	1.09E–07	3.61E–04	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	1.56E–10	^{146}Sm	4.65E–12	2.37E–05	1.10E–16	4.72E–14	1.56E–10	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	6.10E–09	^{147}Sm	1.81E–10	2.37E–05	4.30E–15	1.84E–12	6.10E–09	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	3.13E–14	^{148}Sm	9.30E–16	2.37E–05	2.20E–20	9.46E–18	3.13E–14	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	2.78E–15	^{149}Sm	8.26E–17	2.37E–05	1.96E–21	8.40E–19	2.78E–15	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	2.59E–01	^{151}Sm	7.71E–03	2.37E–05	1.83E–07	7.84E–05	2.60E–01	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	3.21E–13	^{119m}Sn	9.55E–15	2.37E–05	2.26E–19	9.71E–17	3.21E–13	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	1.93E–03	^{121m}Sn	5.74E–05	2.37E–05	1.36E–09	5.83E–07	1.93E–03	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	3.40E–04	^{126}Sn	1.01E–05	2.37E–05	2.39E–10	1.03E–07	3.40E–04	0.00%
^{90}Sr	[d]		1.87E–02	3.50E–01	^{90}Sr	[e]		1.47E–05	6.31E–03	3.56E–01	0.98%
^{98}Tc	6.34E–11	1.8	1.14E–10	2.14E–09	^{98}Tc	6.34E–11	2.37E–05	1.50E–15	6.45E–13	2.14E–09	0.00%
^{99}Tc	[d]		6.17E–04	1.15E–02	^{99}Tc	[e]		6.95E–09	2.98E–06	1.15E–02	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	1.72E–15	^{123}Te	5.12E–17	2.37E–05	1.21E–21	5.21E–19	1.72E–15	0.00%
^{125m}Te	1.43E–05		1.36E–04	2.54E–03	^{125m}Te	1.43E–05	2.37E–05	3.40E–10	1.46E–07	2.54E–03	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	3.98E–08	^{227}Th	1.18E–09	2.37E–05	2.80E–14	1.20E–11	3.98E–08	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	2.41E–06	^{228}Th	7.16E–08	2.37E–05	1.70E–12	7.28E–10	2.41E–06	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	1.89E–10	^{229}Th	5.61E–12	2.37E–05	1.33E–16	5.70E–14	1.89E–10	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	7.92E–07	^{230}Th	2.35E–08	2.37E–05	5.58E–13	2.39E–10	7.92E–07	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	2.67E–05	^{231}Th	7.93E–07	2.37E–05	1.88E–11	8.06E–09	2.67E–05	0.00%

Table A-2. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{232}Th	1.85E–14	1.8	3.33E–14	6.23E–13	^{232}Th	1.85E–14	2.37E–05	4.38E–19	1.88E–16	6.23E–13	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	2.75E–05	^{234}Th	8.17E–07	2.37E–05	1.94E–11	8.30E–09	2.75E–05	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	4.02E–08	^{207}Tl	1.19E–09	2.37E–05	2.83E–14	1.21E–11	4.02E–08	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	8.69E–07	^{208}Tl	2.58E–08	2.37E–05	6.12E–13	2.62E–10	8.69E–07	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	4.08E–12	^{209}Tl	1.21E–13	2.37E–05	2.87E–18	1.23E–15	4.08E–12	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	1.61E–14	^{171}Tm	4.80E–16	2.37E–05	1.14E–20	4.88E–18	1.61E–14	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	2.33E–06	^{232}U	6.91E–08	2.37E–05	1.64E–12	7.03E–10	2.33E–06	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	5.97E–08	^{233}U	1.77E–09	2.37E–05	4.21E–14	1.80E–11	5.98E–08	0.00%
^{234}U	[d]		2.98E–06	5.57E–05	^{234}U	[e]		1.38E–09	5.92E–07	5.63E–05	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	2.67E–05	^{235}U	[e]		3.40E–10	1.46E–07	2.68E–05	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	6.22E–05	^{236}U	1.85E–06	2.37E–05	4.38E–11	1.88E–08	6.23E–05	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	7.23E–06	^{237}U	2.15E–07	2.37E–05	5.09E–12	2.18E–09	7.23E–06	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	2.75E–05	^{238}U	[e]		1.11E–10	4.76E–08	2.75E–05	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	9.88E–13	^{240}U	2.94E–14	2.37E–05	6.96E–19	2.99E–16	9.89E–13	0.00%
^{90}Y	[d]		1.87E–02	3.50E–01	^{90}Y	8.88E–01	2.37E–05	2.11E–05	9.03E–03	3.59E–01	0.99%
^{93}Zr	1.06E–04	1.8	1.90E–04	3.56E–03	^{93}Zr	1.06E–04	2.37E–05	2.51E–09	1.07E–06	3.56E–03	0.01%
			Total	36.12				Total	0.03	36.15	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-104.

Table A-3. Post-decontamination estimated inventory for Tank WM-105.

Solids					Liquid					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ac	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	4.02E–08	^{227}Ac	1.20E–09	2.05E–05	2.45E–14	1.05E–11	4.02E–08	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ac	1.73E–14	2.05E–05	3.54E–19	1.52E–16	5.82E–13	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	9.59E–12	^{108}Ag	2.85E–13	2.05E–05	5.84E–18	2.51E–15	9.59E–12	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	1.08E–10	^{108m}Ag	3.20E–12	2.05E–05	6.56E–17	2.82E–14	1.08E–10	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	8.00E–16	^{109m}Ag	2.38E–17	2.05E–05	4.88E–22	2.09E–19	8.01E–16	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	3.01E–17	^{110}Ag	8.93E–19	2.05E–05	1.83E–23	7.85E–21	3.01E–17	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	2.26E–15	^{110m}Ag	6.71E–17	2.05E–05	1.38E–21	5.90E–19	2.26E–15	0.00%
^{241}Am	[d]		3.40E–04	6.36E–03	^{241}Am	[e]		2.82E–09	1.21E–06	6.36E–03	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	2.40E–05	^{242}Am	7.13E–07	2.05E–05	1.46E–11	6.27E–09	2.40E–05	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	2.41E–05	^{242m}Am	7.17E–07	2.05E–05	1.47E–11	6.31E–09	2.41E–05	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	3.31E–05	^{243}Am	9.83E–07	2.05E–05	2.02E–11	8.65E–09	3.31E–05	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	1.89E–10	^{217}At	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{137m}Ba	[d]		9.20E–01	1.72E+01	^{137m}Ba	[e]		2.05E–05	8.79E–03	1.72E+01	47.62%
^{10}Be	7.56E–11	1.8	1.36E–10	2.55E–09	^{10}Be	7.56E–11	2.05E–05	1.55E–15	6.65E–13	2.55E–09	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Bi	1.11E–10	2.05E–05	2.28E–15	9.80E–13	3.75E–09	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	1.82E–22	^{210m}Bi	5.41E–24	2.05E–05	1.11E–28	4.76E–26	1.82E–22	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Bi	1.20E–09	2.05E–05	2.46E–14	1.05E–11	4.03E–08	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Bi	7.18E–08	2.05E–05	1.47E–12	6.32E–10	2.42E–06	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	1.89E–10	^{213}Bi	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Bi	2.88E–10	2.05E–05	5.89E–15	2.53E–12	9.68E–09	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	7.41E–08	^{14}C	[e]		3.19E–11	1.37E–08	8.77E–08	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	8.00E–16	^{109}Cd	2.38E–17	2.05E–05	4.88E–22	2.09E–19	8.01E–16	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	1.95E–03	^{113m}Cd	5.78E–05	2.05E–05	1.18E–09	5.08E–07	1.95E–03	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	2.46E–08	^{142}Ce	7.31E–10	2.05E–05	1.50E–14	6.43E–12	2.46E–08	0.00%

Table A-3. (continued).

Solids					Liquid					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{144}Ce	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Ce	2.33E–10	2.05E–05	4.77E–15	2.05E–12	7.83E–09	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	2.43E–14	^{249}Cf	7.21E–16	2.05E–05	1.48E–20	6.34E–18	2.43E–14	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	1.26E–14	^{250}Cf	3.73E–16	2.05E–05	7.64E–21	3.28E–18	1.26E–14	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	3.85E–16	^{251}Cf	1.14E–17	2.05E–05	2.34E–22	1.00E–19	3.85E–16	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	1.63E–17	^{252}Cf	4.84E–19	2.05E–05	9.93E–24	4.26E–21	1.63E–17	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	1.99E–05	^{242}Cm	5.91E–07	2.05E–05	1.21E–11	5.20E–09	1.99E–05	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	4.33E–06	^{243}Cm	1.29E–07	2.05E–05	2.64E–12	1.13E–09	4.33E–06	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	2.37E–04	^{244}Cm	[e]		6.83E–11	2.93E–08	2.37E–04	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	5.66E–08	^{245}Cm	1.68E–09	2.05E–05	3.44E–14	1.48E–11	5.66E–08	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	3.71E–09	^{246}Cm	1.10E–10	2.05E–05	2.26E–15	9.69E–13	3.71E–09	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	4.11E–15	^{247}Cm	1.22E–16	2.05E–05	2.50E–21	1.07E–18	4.11E–15	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	4.34E–15	^{248}Cm	1.29E–16	2.05E–05	2.64E–21	1.13E–18	4.34E–15	0.00%
^{60}Co	[d]		5.02E–05	9.39E–04	^{60}Co	[e]		2.35E–09	1.01E–06	9.40E–04	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	1.02E–03	^{134}Cs	3.03E–05	2.05E–05	6.22E–10	2.67E–07	1.02E–03	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	4.84E–04	^{135}Cs	1.44E–05	2.05E–05	2.95E–10	1.26E–07	4.84E–04	0.00%
^{137}Cs	[d]		9.20E–01	1.72E+01	^{137}Cs	[e]		2.05E–05	8.79E–03	1.72E+01	47.62%
^{150}Eu	2.96E–10	1.8	5.34E–10	9.98E–09	^{150}Eu	2.96E–10	2.05E–05	6.08E–15	2.61E–12	9.98E–09	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	1.32E–03	^{152}Eu	3.92E–05	2.05E–05	8.03E–10	3.45E–07	1.32E–03	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	5.88E–02	^{154}Eu	[e]		3.55E–09	1.52E–06	5.88E–02	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	1.59E–02	^{155}Eu	4.74E–04	2.05E–05	9.71E–09	4.17E–06	1.59E–02	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	1.64E–02	^{55}Fe	4.88E–04	2.05E–05	1.00E–08	4.29E–06	1.64E–02	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	1.89E–10	^{221}Fr	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	5.55E–10	^{223}Fr	1.65E–11	2.05E–05	3.38E–16	1.45E–13	5.55E–10	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	1.20E–15	^{152}Gd	3.58E–17	2.05E–05	7.33E–22	3.15E–19	1.20E–15	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	1.40E–17	^{153}Gd	4.15E–19	2.05E–05	8.52E–24	3.65E–21	1.40E–17	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	1.08E–02	^{3}H	[e]		1.28E–08	5.49E–06	1.08E–02	0.03%

Table A-3. (continued).

Solids					Liquid					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{166m}Ho	1.13E–09	1.8	2.03E–09	3.79E–08	^{166m}Ho	1.13E–09	2.05E–05	2.31E–14	9.90E–12	3.79E–08	0.00%
^{129}I	[d]		6.24E–07	1.17E–05	^{129}I	[e]		1.05E–10	4.50E–08	1.17E–05	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	9.26E–15	^{115}In	2.75E–16	2.05E–05	5.64E–21	2.42E–18	9.26E–15	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	1.58E–13	^{138}La	4.68E–15	2.05E–05	9.60E–20	4.12E–17	1.58E–13	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	2.94E–03	^{93m}Nb	8.74E–05	2.05E–05	1.79E–09	7.68E–07	2.94E–03	0.01%
^{94}Nb	[d]		1.66E–04	3.10E–03	^{94}Nb	3.62E–05	2.05E–05	7.42E–10	3.18E–07	3.10E–03	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	1.33E–12	^{144}Nd	3.96E–14	2.05E–05	8.13E–19	3.49E–16	1.33E–12	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	3.79E–04	^{59}Ni	1.13E–05	2.05E–05	2.31E–10	9.91E–08	3.79E–04	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	4.32E–02	^{63}Ni	[e]		8.00E–09	3.43E–06	4.32E–02	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	7.42E–09	^{236}Np	2.21E–10	2.05E–05	4.52E–15	1.94E–12	7.42E–09	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	7.10E–04	^{237}Np	[e]		2.54E–11	1.09E–08	7.10E–04	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	1.21E–07	^{238}Np	3.58E–09	2.05E–05	7.35E–14	3.15E–11	1.21E–07	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	3.31E–05	^{239}Np	9.83E–07	2.05E–05	2.02E–11	8.65E–09	3.31E–05	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	9.88E–13	^{240m}Np	2.94E–14	2.05E–05	6.02E–19	2.58E–16	9.89E–13	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	7.14E–08	^{231}Pa	2.12E–09	2.05E–05	4.35E–14	1.87E–11	7.14E–08	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	7.10E–04	^{233}Pa	2.11E–05	2.05E–05	4.33E–10	1.86E–07	7.10E–04	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	3.57E–08	^{234}Pa	1.06E–09	2.05E–05	2.18E–14	9.33E–12	3.57E–08	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	2.75E–05	^{234m}Pa	8.17E–07	2.05E–05	1.67E–11	7.18E–09	2.75E–05	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	1.89E–10	^{209}Pb	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Pb	1.11E–10	2.05E–05	2.28E–15	9.80E–13	3.75E–09	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Pb	1.20E–09	2.05E–05	2.46E–14	1.05E–11	4.03E–08	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Pb	7.18E–08	2.05E–05	1.47E–12	6.32E–10	2.42E–06	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Pb	2.88E–10	2.05E–05	5.89E–15	2.53E–12	9.68E–09	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	1.37E–05	^{107}Pd	4.06E–07	2.05E–05	8.32E–12	3.57E–09	1.37E–05	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	1.35E–05	^{146}Pm	4.00E–07	2.05E–05	8.20E–12	3.52E–09	1.35E–05	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	1.31E–02	^{147}Pm	3.88E–04	2.05E–05	7.96E–09	3.42E–06	1.31E–02	0.04%

Table A-3. (continued).

Solids					Liquid					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{210}Po	1.08E–10	1.8	1.94E–10	3.62E–09	^{210}Po	1.08E–10	2.05E–05	2.21E–15	9.46E–13	3.62E–09	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	1.13E–10	^{211}Po	3.35E–12	2.05E–05	6.87E–17	2.95E–14	1.13E–10	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	1.55E–06	^{212}Po	4.60E–08	2.05E–05	9.44E–13	4.05E–10	1.55E–06	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	1.85E–10	^{213}Po	5.49E–12	2.05E–05	1.13E–16	4.83E–14	1.85E–10	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	9.68E–09	^{214}Po	2.87E–10	2.05E–05	5.89E–15	2.53E–12	9.68E–09	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	4.03E–08	^{215}Po	1.20E–09	2.05E–05	2.46E–14	1.05E–11	4.03E–08	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	2.42E–06	^{216}Po	7.18E–08	2.05E–05	1.47E–12	6.32E–10	2.42E–06	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	9.68E–09	^{218}Po	2.88E–10	2.05E–05	5.90E–15	2.53E–12	9.68E–09	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Pr	2.33E–10	2.05E–05	4.77E–15	2.05E–12	7.83E–09	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	9.40E–11	^{144m}Pr	2.79E–12	2.05E–05	5.72E–17	2.46E–14	9.40E–11	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	2.20E–07	^{236}Pu	6.52E–09	2.05E–05	1.34E–13	5.74E–11	2.20E–07	0.00%
^{238}Pu	[d]		9.23E–03	1.73E–01	^{238}Pu	[e]		2.43E–08	1.04E–05	1.73E–01	0.48%
^{239}Pu	[d]		2.75E–03	5.14E–02	^{239}Pu	[e]		2.57E–09	1.10E–06	5.14E–02	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	2.04E–02	^{240}Pu	6.06E–04	2.05E–05	1.24E–08	5.33E–06	2.04E–02	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	2.95E–01	^{241}Pu	[e]		1.58E–08	6.78E–06	2.95E–01	0.81%
^{242}Pu	4.43E–07	1.8	7.98E–07	1.49E–05	^{242}Pu	4.43E–07	2.05E–05	9.08E–12	3.90E–09	1.49E–05	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	4.11E–15	^{243}Pu	1.22E–16	2.05E–05	2.50E–21	1.07E–18	4.11E–15	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	9.90E–13	^{244}Pu	2.94E–14	2.05E–05	6.03E–19	2.59E–16	9.90E–13	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	4.03E–08	^{223}Ra	1.20E–09	2.05E–05	2.46E–14	1.05E–11	4.03E–08	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	2.42E–06	^{224}Ra	7.18E–08	2.05E–05	1.47E–12	6.32E–10	2.42E–06	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ra	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	9.68E–09	^{226}Ra	2.88E–10	2.05E–05	5.90E–15	2.53E–12	9.68E–09	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ra	1.73E–14	2.05E–05	3.54E–19	1.52E–16	5.82E–13	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	2.41E–08	^{87}Rb	7.15E–10	2.05E–05	1.46E–14	6.28E–12	2.41E–08	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	8.29E–08	^{102}Rh	2.46E–09	2.05E–05	5.05E–14	2.17E–11	8.30E–08	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Rh	7.69E–09	2.05E–05	1.58E–13	6.76E–11	2.59E–07	0.00%

Table A-3. (continued).

Solids					Liquid					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{219}Rn	1.20E–09	1.8	2.16E–09	4.03E–08	^{219}Rn	1.20E–09	2.05E–05	2.46E–14	1.05E–11	4.03E–08	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	2.42E–06	^{220}Rn	7.18E–08	2.05E–05	1.47E–12	6.32E–10	2.42E–06	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	9.68E–09	^{222}Rn	2.88E–10	2.05E–05	5.90E–15	2.53E–12	9.68E–09	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Ru	7.69E–09	2.05E–05	1.58E–13	6.76E–11	2.59E–07	0.00%
^{125}Sb	[d]		5.55E–04	1.04E–02	^{125}Sb	5.87E–05	2.05E–05	1.20E–09	5.16E–07	1.04E–02	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	4.76E–05	^{126}Sb	1.41E–06	2.05E–05	2.90E–11	1.24E–08	4.76E–05	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	3.40E–04	^{126m}Sb	1.01E–05	2.05E–05	2.07E–10	8.89E–08	3.40E–04	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	3.61E–04	^{79}Se	1.07E–05	2.05E–05	2.20E–10	9.44E–08	3.61E–04	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	1.56E–10	^{146}Sm	4.65E–12	2.05E–05	9.52E–17	4.09E–14	1.56E–10	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	6.10E–09	^{147}Sm	1.81E–10	2.05E–05	3.72E–15	1.59E–12	6.10E–09	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	3.13E–14	^{148}Sm	9.30E–16	2.05E–05	1.91E–20	8.18E–18	3.13E–14	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	2.78E–15	^{149}Sm	8.26E–17	2.05E–05	1.69E–21	7.26E–19	2.78E–15	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	2.59E–01	^{151}Sm	7.71E–03	2.05E–05	1.58E–07	6.78E–05	2.59E–01	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	3.21E–13	^{119m}Sn	9.55E–15	2.05E–05	1.96E–19	8.40E–17	3.21E–13	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	1.93E–03	^{121m}Sn	5.74E–05	2.05E–05	1.18E–09	5.05E–07	1.93E–03	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	3.40E–04	^{126}Sn	1.01E–05	2.05E–05	2.07E–10	8.89E–08	3.40E–04	0.00%
^{90}Sr	[d]		1.87E–02	3.50E–01	^{90}Sr	[e]		1.49E–05	6.39E–03	3.56E–01	0.99%
^{98}Tc	6.34E–11	1.8	1.14E–10	2.14E–09	^{98}Tc	6.34E–11	2.05E–05	1.30E–15	5.58E–13	2.14E–09	0.00%
^{99}Tc	[d]		6.17E–04	1.15E–02	^{99}Tc	[e]		5.25E–09	2.25E–06	1.15E–02	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	1.72E–15	^{123}Te	5.12E–17	2.05E–05	1.05E–21	4.51E–19	1.72E–15	0.00%
^{125m}Te	1.43E–05		1.36E–04	2.54E–03	^{125m}Te	1.43E–05	2.05E–05	2.94E–10	1.26E–07	2.54E–03	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	3.98E–08	^{227}Th	1.18E–09	2.05E–05	2.42E–14	1.04E–11	3.98E–08	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	2.41E–06	^{228}Th	7.16E–08	2.05E–05	1.47E–12	6.30E–10	2.41E–06	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	1.89E–10	^{229}Th	5.61E–12	2.05E–05	1.15E–16	4.93E–14	1.89E–10	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	7.92E–07	^{230}Th	2.35E–08	2.05E–05	4.82E–13	2.07E–10	7.92E–07	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	2.67E–05	^{231}Th	7.93E–07	2.05E–05	1.63E–11	6.97E–09	2.67E–05	0.00%

Table A-3. (continued).

Solids					Liquid					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{232}Th	1.85E–14	1.8	3.33E–14	6.23E–13	^{232}Th	1.85E–14	2.05E–05	3.79E–19	1.63E–16	6.23E–13	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	2.75E–05	^{234}Th	8.17E–07	2.05E–05	1.67E–11	7.18E–09	2.75E–05	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	4.02E–08	^{207}Tl	1.19E–09	2.05E–05	2.45E–14	1.05E–11	4.02E–08	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	8.69E–07	^{208}Tl	2.58E–08	2.05E–05	5.29E–13	2.27E–10	8.69E–07	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	4.08E–12	^{209}Tl	1.21E–13	2.05E–05	2.48E–18	1.07E–15	4.08E–12	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	1.61E–14	^{171}Tm	4.80E–16	2.05E–05	9.83E–21	4.22E–18	1.61E–14	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	2.33E–06	^{232}U	6.91E–08	2.05E–05	1.42E–12	6.08E–10	2.33E–06	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	5.97E–08	^{233}U	1.77E–09	2.05E–05	3.64E–14	1.56E–11	5.97E–08	0.00%
^{234}U	[d]		2.98E–06	5.57E–05	^{234}U	[e]		7.11E–11	3.05E–08	5.58E–05	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	2.67E–05	^{235}U	[e]		9.60E–12	4.12E–09	2.67E–05	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	6.22E–05	^{236}U	1.85E–06	2.05E–05	3.79E–11	1.63E–08	6.23E–05	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	7.23E–06	^{237}U	2.15E–07	2.05E–05	4.40E–12	1.89E–09	7.23E–06	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	2.75E–05	^{238}U	8.17E–07	2.05E–05	1.67E–11	7.18E–09	2.75E–05	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	9.88E–13	^{240}U	2.94E–14	2.05E–05	6.02E–19	2.58E–16	9.89E–13	0.00%
^{90}Y	[d]		1.87E–02	3.50E–01	^{90}Y	8.88E–01	2.05E–05	1.82E–05	7.81E–03	3.58E–01	0.99%
^{93}Zr	1.06E–04	1.8	1.90E–04	3.56E–03	^{93}Zr	1.06E–04	2.05E–05	2.17E–09	9.30E–07	3.56E–03	0.01%
			Total	36.12				Total	0.03	36.15	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-105.

Table A-4. Post-decontamination estimated inventory for Tank WM-106.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ac	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	4.02E–08	^{227}Ac	1.20E–09	6.91E–05	8.26E–14	3.54E–11	4.03E–08	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ac	1.73E–14	6.91E–05	1.19E–18	5.12E–16	5.82E–13	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	9.59E–12	^{108}Ag	2.85E–13	6.91E–05	1.97E–17	8.45E–15	9.60E–12	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	1.08E–10	^{108m}Ag	3.20E–12	6.91E–05	2.21E–16	9.49E–14	1.08E–10	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	8.00E–16	^{109m}Ag	2.38E–17	6.91E–05	1.64E–21	7.05E–19	8.01E–16	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	3.01E–17	^{110}Ag	8.93E–19	6.91E–05	6.17E–23	2.65E–20	3.01E–17	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	2.26E–15	^{110m}Ag	6.71E–17	6.91E–05	4.64E–21	1.99E–18	2.26E–15	0.00%
^{241}Am	[d]		3.40E–04	6.36E–03	^{241}Am	[e]		4.31E–09	1.85E–06	6.36E–03	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	2.40E–05	^{242}Am	7.13E–07	6.91E–05	4.93E–11	2.12E–08	2.40E–05	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	2.41E–05	^{242m}Am	7.17E–07	6.91E–05	4.95E–11	2.13E–08	2.42E–05	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	3.31E–05	^{243}Am	9.83E–07	6.91E–05	6.79E–11	2.91E–08	3.31E–05	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	1.89E–10	^{217}At	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{137m}Ba	[d]		9.20E–01	1.72E+01	^{137m}Ba	[e]		6.91E–05	2.96E–02	1.72E+01	46.90%
^{10}Be	7.56E–11	1.8	1.36E–10	2.55E–09	^{10}Be	7.56E–11	6.91E–05	5.23E–15	2.24E–12	2.55E–09	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Bi	1.11E–10	6.91E–05	7.70E–15	3.30E–12	3.75E–09	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	1.82E–22	^{210m}Bi	5.41E–24	6.91E–05	3.74E–28	1.61E–25	1.82E–22	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Bi	1.20E–09	6.91E–05	8.28E–14	3.55E–11	4.03E–08	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Bi	7.18E–08	6.91E–05	4.96E–12	2.13E–09	2.42E–06	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	1.89E–10	^{213}Bi	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Bi	2.88E–10	6.91E–05	1.99E–14	8.52E–12	9.69E–09	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	7.41E–08	^{14}C	[e]		1.23E–12	5.28E–10	7.46E–08	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	8.00E–16	^{109}Cd	2.38E–17	6.91E–05	1.64E–21	7.05E–19	8.01E–16	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	1.95E–03	^{113m}Cd	5.78E–05	6.91E–05	3.99E–09	1.71E–06	1.95E–03	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	2.46E–08	^{142}Ce	7.31E–10	6.91E–05	5.05E–14	2.17E–11	2.46E–08	0.00%

Table A-4. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{144}Ce	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Ce	2.33E–10	6.91E–05	1.61E–14	6.90E–12	7.84E–09	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	2.43E–14	^{249}Cf	7.21E–16	6.91E–05	4.98E–20	2.14E–17	2.43E–14	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	1.26E–14	^{250}Cf	3.73E–16	6.91E–05	2.58E–20	1.11E–17	1.26E–14	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	3.85E–16	^{251}Cf	1.14E–17	6.91E–05	7.90E–22	3.39E–19	3.85E–16	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	1.63E–17	^{252}Cf	4.84E–19	6.91E–05	3.35E–23	1.44E–20	1.63E–17	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	1.99E–05	^{242}Cm	5.91E–07	6.91E–05	4.09E–11	1.75E–08	1.99E–05	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	4.33E–06	^{243}Cm	1.29E–07	6.91E–05	8.88E–12	3.81E–09	4.33E–06	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	2.37E–04	^{244}Cm	[e]		1.60E–11	6.86E–09	2.37E–04	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	5.66E–08	^{245}Cm	1.68E–09	6.91E–05	1.16E–13	4.98E–11	5.66E–08	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	3.71E–09	^{246}Cm	1.10E–10	6.91E–05	7.61E–15	3.27E–12	3.71E–09	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	4.11E–15	^{247}Cm	1.22E–16	6.91E–05	8.43E–21	3.62E–18	4.11E–15	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	4.34E–15	^{248}Cm	1.29E–16	6.91E–05	8.90E–21	3.82E–18	4.34E–15	0.00%
^{60}Co	[d]		5.02E–05	9.39E–04	^{60}Co	[e]		6.91E–09	2.96E–06	9.42E–04	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	1.02E–03	^{134}Cs	3.03E–05	6.91E–05	2.10E–09	8.99E–07	1.02E–03	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	4.84E–04	^{135}Cs	1.44E–05	6.91E–05	9.94E–10	4.26E–07	4.85E–04	0.00%
^{137}Cs	[d]		9.20E–01	1.72E+01	^{137}Cs	[e]		6.91E–05	2.96E–02	1.72E+01	46.90%
^{150}Eu	2.96E–10	1.8	5.34E–10	9.98E–09	^{150}Eu	2.96E–10	6.91E–05	2.05E–14	8.79E–12	9.99E–09	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	1.32E–03	^{152}Eu	3.92E–05	6.91E–05	2.71E–09	1.16E–06	1.32E–03	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	5.88E–02	^{154}Eu	[e]		1.31E–08	5.62E–06	5.88E–02	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	1.59E–02	^{155}Eu	4.74E–04	6.91E–05	3.27E–08	1.40E–05	1.60E–02	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	1.64E–02	^{55}Fe	4.88E–04	6.91E–05	3.37E–08	1.45E–05	1.64E–02	0.04%
^{221}Fr	5.61E–12	1.8	1.01E–11	1.89E–10	^{221}Fr	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	5.55E–10	^{223}Fr	1.65E–11	6.91E–05	1.14E–15	4.89E–13	5.56E–10	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	1.20E–15	^{152}Gd	3.58E–17	6.91E–05	2.47E–21	1.06E–18	1.21E–15	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	1.40E–17	^{153}Gd	4.15E–19	6.91E–05	2.87E–23	1.23E–20	1.40E–17	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	1.08E–02	^{3}H	[e]		9.10E–09	3.90E–06	1.08E–02	0.03%

Table A-4. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{166m}Ho	1.13E–09	1.8	2.03E–09	3.79E–08	^{166m}Ho	1.13E–09	6.91E–05	7.78E–14	3.34E–11	3.79E–08	0.00%
^{129}I	[d]		6.24E–07	1.17E–05	^{129}I	[e]		6.95E–11	2.98E–08	1.17E–05	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	9.26E–15	^{115}In	2.75E–16	6.91E–05	1.90E–20	8.15E–18	9.27E–15	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	1.58E–13	^{138}La	4.68E–15	6.91E–05	3.24E–19	1.39E–16	1.58E–13	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	2.94E–03	^{93m}Nb	8.74E–05	6.91E–05	6.04E–09	2.59E–06	2.94E–03	0.01%
^{94}Nb	[d]		1.66E–04	3.10E–03	^{94}Nb	[e]		4.37E–08	1.87E–05	3.12E–03	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	1.33E–12	^{144}Nd	3.96E–14	6.91E–05	2.74E–18	1.18E–15	1.34E–12	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	3.79E–04	^{59}Ni	1.13E–05	6.91E–05	7.79E–10	3.34E–07	3.80E–04	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	4.32E–02	^{63}Ni	[e]		2.04E–08	8.75E–06	4.32E–02	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	7.42E–09	^{236}Np	2.21E–10	6.91E–05	1.52E–14	6.54E–12	7.43E–09	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	7.10E–04	^{237}Np	[e]		8.18E–11	3.51E–08	7.10E–04	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	1.21E–07	^{238}Np	3.58E–09	6.91E–05	2.48E–13	1.06E–10	1.21E–07	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	3.31E–05	^{239}Np	9.83E–07	6.91E–05	6.79E–11	2.91E–08	3.31E–05	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	9.88E–13	^{240m}Np	2.94E–14	6.91E–05	2.03E–18	8.70E–16	9.89E–13	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	7.14E–08	^{231}Pa	2.12E–09	6.91E–05	1.47E–13	6.29E–11	7.14E–08	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	7.10E–04	^{233}Pa	2.11E–05	6.91E–05	1.46E–09	6.26E–07	7.11E–04	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	3.57E–08	^{234}Pa	1.06E–09	6.91E–05	7.33E–14	3.15E–11	3.58E–08	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	2.75E–05	^{234m}Pa	8.17E–07	6.91E–05	5.64E–11	2.42E–08	2.75E–05	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	1.89E–10	^{209}Pb	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	3.75E–09	^{210}Pb	1.11E–10	6.91E–05	7.70E–15	3.30E–12	3.75E–09	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	4.03E–08	^{211}Pb	1.20E–09	6.91E–05	8.28E–14	3.55E–11	4.03E–08	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	2.42E–06	^{212}Pb	7.18E–08	6.91E–05	4.96E–12	2.13E–09	2.42E–06	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	9.68E–09	^{214}Pb	2.88E–10	6.91E–05	1.99E–14	8.52E–12	9.69E–09	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	1.37E–05	^{107}Pd	4.06E–07	6.91E–05	2.80E–11	1.20E–08	1.37E–05	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	1.35E–05	^{146}Pm	4.00E–07	6.91E–05	2.76E–11	1.19E–08	1.35E–05	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	1.31E–02	^{147}Pm	3.88E–04	6.91E–05	2.68E–08	1.15E–05	1.31E–02	0.04%

Table A-4. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{210}Po	1.08E–10	1.8	1.94E–10	3.62E–09	^{210}Po	1.08E–10	6.91E–05	7.44E–15	3.19E–12	3.63E–09	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	1.13E–10	^{211}Po	3.35E–12	6.91E–05	2.32E–16	9.94E–14	1.13E–10	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	1.55E–06	^{212}Po	4.60E–08	6.91E–05	3.18E–12	1.36E–09	1.55E–06	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	1.85E–10	^{213}Po	5.49E–12	6.91E–05	3.79E–16	1.63E–13	1.85E–10	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	9.68E–09	^{214}Po	2.87E–10	6.91E–05	1.99E–14	8.52E–12	9.68E–09	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	4.03E–08	^{215}Po	1.20E–09	6.91E–05	8.28E–14	3.55E–11	4.03E–08	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	2.42E–06	^{216}Po	7.18E–08	6.91E–05	4.96E–12	2.13E–09	2.42E–06	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	9.68E–09	^{218}Po	2.88E–10	6.91E–05	1.99E–14	8.52E–12	9.69E–09	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	7.83E–09	^{144}Pr	2.33E–10	6.91E–05	1.61E–14	6.90E–12	7.84E–09	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	9.40E–11	^{144m}Pr	2.79E–12	6.91E–05	1.93E–16	8.28E–14	9.41E–11	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	2.20E–07	^{236}Pu	6.52E–09	6.91E–05	4.51E–13	1.93E–10	2.20E–07	0.00%
^{238}Pu	[d]		9.23E–03	1.73E–01	^{238}Pu	[e]		3.84E–08	1.65E–05	1.73E–01	0.47%
^{239}Pu	[d]		2.75E–03	5.14E–02	^{239}Pu	[e]		6.19E–09	2.66E–06	5.14E–02	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	2.04E–02	^{240}Pu	6.06E–04	6.91E–05	4.19E–08	1.80E–05	2.04E–02	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	2.95E–01	^{241}Pu	[e]		2.84E–08	1.22E–05	2.95E–01	0.80%
^{242}Pu	4.43E–07	1.8	7.98E–07	1.49E–05	^{242}Pu	4.43E–07	6.91E–05	3.06E–11	1.31E–08	1.49E–05	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	4.11E–15	^{243}Pu	1.22E–16	6.91E–05	8.43E–21	3.62E–18	4.11E–15	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	9.90E–13	^{244}Pu	2.94E–14	6.91E–05	2.03E–18	8.72E–16	9.90E–13	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	4.03E–08	^{223}Ra	1.20E–09	6.91E–05	8.28E–14	3.55E–11	4.03E–08	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	2.42E–06	^{224}Ra	7.18E–08	6.91E–05	4.96E–12	2.13E–09	2.42E–06	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	1.89E–10	^{225}Ra	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	9.68E–09	^{226}Ra	2.88E–10	6.91E–05	1.99E–14	8.52E–12	9.69E–09	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	5.81E–13	^{228}Ra	1.73E–14	6.91E–05	1.19E–18	5.12E–16	5.82E–13	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	2.41E–08	^{87}Rb	7.15E–10	6.91E–05	4.94E–14	2.12E–11	2.41E–08	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	8.29E–08	^{102}Rh	2.46E–09	6.91E–05	1.70E–13	7.30E–11	8.30E–08	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Rh	7.69E–09	6.91E–05	5.31E–13	2.28E–10	2.59E–07	0.00%

Table A-4. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{219}Rn	1.20E–09	1.8	2.16E–09	4.03E–08	^{219}Rn	1.20E–09	6.91E–05	8.28E–14	3.55E–11	4.03E–08	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	2.42E–06	^{220}Rn	7.18E–08	6.91E–05	4.96E–12	2.13E–09	2.42E–06	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	9.68E–09	^{222}Rn	2.88E–10	6.91E–05	1.99E–14	8.52E–12	9.69E–09	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	2.59E–07	^{106}Ru	7.69E–09	6.91E–05	5.31E–13	2.28E–10	2.59E–07	0.00%
^{125}Sb	[d]		5.55E–04	1.04E–02	^{125}Sb	5.87E–05	6.91E–05	4.06E–09	1.74E–06	1.04E–02	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	4.76E–05	^{126}Sb	1.41E–06	6.91E–05	9.78E–11	4.19E–08	4.77E–05	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	3.40E–04	^{126m}Sb	1.01E–05	6.91E–05	6.98E–10	3.00E–07	3.40E–04	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	3.61E–04	^{79}Se	1.07E–05	6.91E–05	7.41E–10	3.18E–07	3.62E–04	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	1.56E–10	^{146}Sm	4.65E–12	6.91E–05	3.21E–16	1.38E–13	1.57E–10	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	6.10E–09	^{147}Sm	1.81E–10	6.91E–05	1.25E–14	5.37E–12	6.11E–09	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	3.13E–14	^{148}Sm	9.30E–16	6.91E–05	6.43E–20	2.76E–17	3.13E–14	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	2.78E–15	^{149}Sm	8.26E–17	6.91E–05	5.71E–21	2.45E–18	2.78E–15	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	2.59E–01	^{151}Sm	7.71E–03	6.91E–05	5.33E–07	2.28E–04	2.60E–01	0.71%
^{119m}Sn	9.55E–15	1.8	1.72E–14	3.21E–13	^{119m}Sn	9.55E–15	6.91E–05	6.60E–19	2.83E–16	3.22E–13	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	1.93E–03	^{121m}Sn	5.74E–05	6.91E–05	3.96E–09	1.70E–06	1.93E–03	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	3.40E–04	^{126}Sn	1.01E–05	6.91E–05	6.98E–10	3.00E–07	3.40E–04	0.00%
^{90}Sr	[d]		1.87E–02	3.50E–01	^{90}Sr	[e]		6.61E–04	2.84E–01	6.33E–01	1.72%
^{98}Tc	6.34E–11	1.8	1.14E–10	2.14E–09	^{98}Tc	6.34E–11	6.91E–05	4.38E–15	1.88E–12	2.14E–09	0.00%
^{99}Tc	[d]		6.17E–04	1.15E–02	^{99}Tc	[e]		1.94E–07	8.32E–05	1.16E–02	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	1.72E–15	^{123}Te	5.12E–17	6.91E–05	3.54E–21	1.52E–18	1.73E–15	0.00%
^{125m}Te	1.43E–05		1.36E–04	2.54E–03	^{125m}Te	1.43E–05	6.91E–05	9.90E–10	4.25E–07	2.54E–03	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	3.98E–08	^{227}Th	1.18E–09	6.91E–05	8.16E–14	3.50E–11	3.98E–08	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	2.41E–06	^{228}Th	7.16E–08	6.91E–05	4.95E–12	2.12E–09	2.41E–06	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	1.89E–10	^{229}Th	5.61E–12	6.91E–05	3.87E–16	1.66E–13	1.89E–10	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	7.92E–07	^{230}Th	2.35E–08	6.91E–05	1.63E–12	6.98E–10	7.93E–07	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	2.67E–05	^{231}Th	7.93E–07	6.91E–05	5.48E–11	2.35E–08	2.67E–05	0.00%

Table A-4. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{232}Th	1.85E–14	1.8	3.33E–14	6.23E–13	^{232}Th	1.85E–14	6.91E–05	1.28E–18	5.48E–16	6.23E–13	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	2.75E–05	^{234}Th	8.17E–07	6.91E–05	5.64E–11	2.42E–08	2.75E–05	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	4.02E–08	^{207}Tl	1.19E–09	6.91E–05	8.25E–14	3.54E–11	4.02E–08	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	8.69E–07	^{208}Tl	2.58E–08	6.91E–05	1.78E–12	7.65E–10	8.70E–07	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	4.08E–12	^{209}Tl	1.21E–13	6.91E–05	8.37E–18	3.59E–15	4.08E–12	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	1.61E–14	^{171}Tm	4.80E–16	6.91E–05	3.31E–20	1.42E–17	1.62E–14	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	2.33E–06	^{232}U	6.91E–08	6.91E–05	4.77E–12	2.05E–09	2.33E–06	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	5.97E–08	^{233}U	1.77E–09	6.91E–05	1.23E–13	5.26E–11	5.98E–08	0.00%
^{234}U	[d]		2.98E–06	5.57E–05	^{234}U	[e]		7.08E–11	3.04E–08	5.58E–05	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	2.67E–05	^{235}U	[e]		7.74E–12	3.32E–09	2.67E–05	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	6.22E–05	^{236}U	1.85E–06	6.91E–05	1.28E–10	5.48E–08	6.23E–05	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	7.23E–06	^{237}U	2.15E–07	6.91E–05	1.48E–11	6.36E–09	7.23E–06	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	2.75E–05	^{238}U	8.17E–07	6.91E–05	5.64E–11	2.42E–08	2.75E–05	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	9.88E–13	^{240}U	2.94E–14	6.91E–05	2.03E–18	8.70E–16	9.89E–13	0.00%
^{90}Y	[d]		1.87E–02	3.50E–01	^{90}Y	8.88E–01	6.91E–05	6.14E–05	2.63E–02	3.76E–01	1.72%
^{93}Zr	1.06E–04	1.8	1.90E–04	3.56E–03	^{93}Zr	1.06E–04	6.91E–05	7.31E–09	3.13E–06	3.56E–03	0.01%
			Total	36.1				Total	0.6	36.7	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-106.

Table A-5. Post-decontamination estimated inventory for Tank WM-180.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	5.47E–09	^{225}Ac	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	1.17E–06	^{227}Ac	1.20E–09	4.38E–07	5.24E–16	2.61E–12	1.17E–06	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	1.68E–11	^{228}Ac	1.73E–14	4.38E–07	7.57E–21	3.77E–17	1.68E–11	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	2.78E–10	^{108}Ag	2.85E–13	4.38E–07	1.25E–19	6.23E–16	2.78E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	3.12E–09	^{108m}Ag	3.20E–12	4.38E–07	1.40E–18	7.00E–15	3.12E–09	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	2.32E–14	^{109m}Ag	2.38E–17	4.38E–07	1.04E–23	5.20E–20	2.32E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	8.71E–16	^{110}Ag	8.93E–19	4.38E–07	3.91E–25	1.95E–21	8.71E–16	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	6.55E–14	^{110m}Ag	6.71E–17	4.38E–07	2.94E–23	1.47E–19	6.55E–14	0.00%
^{241}Am	[d]		3.40E–04	1.84E–01	^{241}Am	[e]		6.63E–10	3.31E–06	1.84E–01	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	6.96E–04	^{242}Am	7.13E–07	4.38E–07	3.13E–13	1.56E–09	6.96E–04	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	6.99E–04	^{242m}Am	7.17E–07	4.38E–07	3.14E–13	1.57E–09	6.99E–04	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	9.59E–04	^{243}Am	9.83E–07	4.38E–07	4.31E–13	2.15E–09	9.59E–04	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	5.47E–09	^{217}At	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{137m}Ba	[d]		9.20E–01	4.99E+02	^{137m}Ba	[e]		4.38E–07	2.19E–03	4.99E+02	47.64%
^{10}Be	7.56E–11	1.8	1.36E–10	7.38E–08	^{10}Be	7.56E–11	4.38E–07	3.31E–17	1.65E–13	7.38E–08	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	1.09E–07	^{210}Bi	1.11E–10	4.38E–07	4.88E–17	2.44E–13	1.09E–07	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	5.28E–21	^{210m}Bi	5.41E–24	4.38E–07	2.37E–30	1.18E–26	5.28E–21	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	1.17E–06	^{211}Bi	1.20E–09	4.38E–07	5.25E–16	2.62E–12	1.17E–06	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	7.01E–05	^{212}Bi	7.18E–08	4.38E–07	3.15E–14	1.57E–10	7.01E–05	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	5.47E–09	^{213}Bi	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	2.80E–07	^{214}Bi	2.88E–10	4.38E–07	1.26E–16	6.28E–13	2.80E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	2.15E–06	^{14}C	2.20E–09	4.38E–07	9.64E–16	4.81E–12	2.15E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	2.32E–14	^{109}Cd	2.38E–17	4.38E–07	1.04E–23	5.20E–20	2.32E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	5.64E–02	^{113m}Cd	5.78E–05	4.38E–07	2.53E–11	1.26E–07	5.64E–02	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	7.13E–07	^{142}Ce	7.31E–10	4.38E–07	3.20E–16	1.60E–12	7.13E–07	0.00%
^{144}Ce	2.33E–10	1.8	4.19E–10	2.27E–07	^{144}Ce	2.33E–10	4.38E–07	1.02E–16	5.08E–13	2.27E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	7.03E–13	^{249}Cf	7.21E–16	4.38E–07	3.16E–22	1.57E–18	7.03E–13	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	3.64E–13	^{250}Cf	3.73E–16	4.38E–07	1.63E–22	8.15E–19	3.64E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	1.11E–14	^{251}Cf	1.14E–17	4.38E–07	5.00E–24	2.50E–20	1.11E–14	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	4.72E–16	^{252}Cf	4.84E–19	4.38E–07	2.12E–25	1.06E–21	4.72E–16	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	5.77E–04	^{242}Cm	5.91E–07	4.38E–07	2.59E–13	1.29E–09	5.77E–04	0.00%

Table A-5. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{243}Cm	1.29E–07	1.8	2.31E–07	1.25E–04	^{243}Cm	1.29E–07	4.38E–07	5.63E–14	2.81E–10	1.25E–04	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	6.86E–03	^{244}Cm	[e]		2.84E–11	1.42E–07	6.86E–03	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	1.64E–06	^{245}Cm	1.68E–09	4.38E–07	7.36E–16	3.67E–12	1.64E–06	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	1.07E–07	^{246}Cm	1.10E–10	4.38E–07	4.82E–17	2.41E–13	1.07E–07	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	1.19E–13	^{247}Cm	1.22E–16	4.38E–07	5.34E–23	2.67E–19	1.19E–13	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	1.26E–13	^{248}Cm	1.29E–16	4.38E–07	5.64E–23	2.81E–19	1.26E–13	0.00%
^{60}Co	[d]		5.02E–05	2.72E–02	^{60}Co	[e]		2.14E–10	1.07E–06	2.72E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	2.96E–02	^{134}Cs	3.03E–05	4.38E–07	1.33E–11	6.63E–08	2.96E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	1.40E–02	^{135}Cs	1.44E–05	4.38E–07	6.30E–12	3.14E–08	1.40E–02	0.00%
^{137}Cs	[d]		9.20E–01	4.99E+02	^{137}Cs	[e]		4.38E–07	2.19E–03	4.99E+02	47.64%
^{150}Eu	2.96E–10	1.8	5.34E–10	2.89E–07	^{150}Eu	2.96E–10	4.38E–07	1.30E–16	6.48E–13	2.89E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	3.82E–02	^{152}Eu	3.92E–05	4.38E–07	1.72E–11	8.56E–08	3.82E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	1.70E+00	^{154}Eu	[e]		7.26E–11	3.62E–07	1.70E+00	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	4.62E–01	^{155}Eu	4.74E–04	4.38E–07	2.07E–10	1.04E–06	4.62E–01	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	4.76E–01	^{55}Fe	4.88E–04	4.38E–07	2.14E–10	1.07E–06	4.76E–01	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	5.47E–09	^{221}Fr	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	1.61E–08	^{223}Fr	1.65E–11	4.38E–07	7.23E–18	3.60E–14	1.61E–08	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	3.49E–14	^{152}Gd	3.58E–17	4.38E–07	1.57E–23	7.82E–20	3.49E–14	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	4.05E–16	^{153}Gd	4.15E–19	4.38E–07	1.82E–25	9.08E–22	4.05E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	3.14E–01	^{3}H	3.22E–04	4.38E–07	1.41E–10	7.03E–07	3.14E–01	0.03%
^{166m}Ho	1.13E–09	1.8	2.03E–09	1.10E–06	^{166m}Ho	1.13E–09	4.38E–07	4.93E–16	2.46E–12	1.10E–06	0.00%
^{129}I	[d]		6.24E–07	3.38E–04	^{129}I	5.88E–07	4.38E–07	2.58E–13	1.29E–09	3.38E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	2.68E–13	^{115}In	2.75E–16	4.38E–07	1.20E–22	6.01E–19	2.68E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	4.57E–12	^{138}La	4.68E–15	4.38E–07	2.05E–21	1.02E–17	4.57E–12	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	8.52E–02	^{93m}Nb	8.74E–05	4.38E–07	3.83E–11	1.91E–07	8.52E–02	0.01%
^{94}Nb	[d]		1.66E–04	9.00E–02	^{94}Nb	[e]		4.67E–11	2.33E–07	9.00E–02	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	3.87E–11	^{144}Nd	3.96E–14	4.38E–07	1.74E–20	8.66E–17	3.87E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	1.10E–02	^{59}Ni	1.13E–05	4.38E–07	4.94E–12	2.46E–08	1.10E–02	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	1.25E+00	^{63}Ni	[e]		1.07E–10	5.34E–07	1.25E+00	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	2.15E–07	^{236}Np	2.21E–10	4.38E–07	9.66E–17	4.82E–13	2.15E–07	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	2.06E–02	^{237}Np	[e]		1.35E–10	6.74E–07	2.06E–02	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	3.50E–06	^{238}Np	3.58E–09	4.38E–07	1.57E–15	7.83E–12	3.50E–06	0.00%

Table A-5. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{239}Np	9.83E–07	1.8	1.77E–06	9.59E–04	^{239}Np	9.83E–07	4.38E–07	4.31E–13	2.15E–09	9.59E–04	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	2.86E–11	^{240m}Np	2.94E–14	4.38E–07	1.29E–20	6.42E–17	2.86E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	2.07E–06	^{231}Pa	2.12E–09	4.38E–07	9.29E–16	4.63E–12	2.07E–06	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	2.06E–02	^{233}Pa	2.11E–05	4.38E–07	9.24E–12	4.61E–08	2.06E–02	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	1.04E–06	^{234}Pa	1.06E–09	4.38E–07	4.65E–16	2.32E–12	1.04E–06	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	7.97E–04	^{234m}Pa	8.17E–07	4.38E–07	3.58E–13	1.78E–09	7.97E–04	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	5.47E–09	^{209}Pb	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	1.09E–07	^{210}Pb	1.11E–10	4.38E–07	4.88E–17	2.43E–13	1.09E–07	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	1.17E–06	^{211}Pb	1.20E–09	4.38E–07	5.25E–16	2.62E–12	1.17E–06	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	7.01E–05	^{212}Pb	7.18E–08	4.38E–07	3.15E–14	1.57E–10	7.01E–05	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	2.80E–07	^{214}Pb	2.88E–10	4.38E–07	1.26E–16	6.28E–13	2.80E–07	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	3.96E–04	^{107}Pd	4.06E–07	4.38E–07	1.78E–13	8.87E–10	3.96E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	3.90E–04	^{146}Pm	4.00E–07	4.38E–07	1.75E–13	8.74E–10	3.90E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	3.79E–01	^{147}Pm	3.88E–04	4.38E–07	1.70E–10	8.49E–07	3.79E–01	0.04%
^{210}Po	1.08E–10	1.8	1.94E–10	1.05E–07	^{210}Po	1.08E–10	4.38E–07	4.71E–17	2.35E–13	1.05E–07	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	3.27E–09	^{211}Po	3.35E–12	4.38E–07	1.47E–18	7.33E–15	3.27E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	4.49E–05	^{212}Po	4.60E–08	4.38E–07	2.02E–14	1.01E–10	4.49E–05	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	5.35E–09	^{213}Po	5.49E–12	4.38E–07	2.40E–18	1.20E–14	5.35E–09	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	2.80E–07	^{214}Po	2.87E–10	4.38E–07	1.26E–16	6.28E–13	2.80E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	1.17E–06	^{215}Po	1.20E–09	4.38E–07	5.25E–16	2.62E–12	1.17E–06	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	7.01E–05	^{216}Po	7.18E–08	4.38E–07	3.15E–14	1.57E–10	7.01E–05	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	2.80E–07	^{218}Po	2.88E–10	4.38E–07	1.26E–16	6.28E–13	2.80E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	2.27E–07	^{144}Pr	2.33E–10	4.38E–07	1.02E–16	5.08E–13	2.27E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	2.72E–09	^{144m}Pr	2.79E–12	4.38E–07	1.22E–18	6.10E–15	2.72E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	6.36E–06	^{236}Pu	6.52E–09	4.38E–07	2.86E–15	1.43E–11	6.36E–06	0.00%
^{238}Pu	[d]		9.23E–03	5.00E+00	^{238}Pu	[e]		3.77E–08	1.88E–04	5.00E+00	0.48%
^{239}Pu	[d]		2.75E–03	1.49E+00	^{239}Pu	[e]		6.99E–09	3.49E–05	1.49E+00	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	5.91E–01	^{240}Pu	6.06E–04	4.38E–07	2.65E–10	1.32E–06	5.91E–01	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	8.53E+00	^{241}Pu	[e]		3.45E–08	1.72E–04	8.53E+00	0.82%
^{242}Pu	4.43E–07	1.8	7.98E–07	4.32E–04	^{242}Pu	4.43E–07	4.38E–07	1.94E–13	9.68E–10	4.32E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	1.19E–13	^{243}Pu	1.22E–16	4.38E–07	5.34E–23	2.67E–19	1.19E–13	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	2.87E–11	^{244}Pu	2.94E–14	4.38E–07	1.29E–20	6.42E–17	2.87E–11	0.00%

Table A-5. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{223}Ra	1.20E–09	1.8	2.16E–09	1.17E–06	^{223}Ra	1.20E–09	4.38E–07	5.25E–16	2.62E–12	1.17E–06	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	7.01E–05	^{224}Ra	7.18E–08	4.38E–07	3.15E–14	1.57E–10	7.01E–05	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	5.47E–09	^{225}Ra	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	2.80E–07	^{226}Ra	2.88E–10	4.38E–07	1.26E–16	6.28E–13	2.80E–07	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	1.68E–11	^{228}Ra	1.73E–14	4.38E–07	7.57E–21	3.77E–17	1.68E–11	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	6.97E–07	^{87}Rb	7.15E–10	4.38E–07	3.13E–16	1.56E–12	6.97E–07	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	2.40E–06	^{102}Rh	2.46E–09	4.38E–07	1.08E–15	5.38E–12	2.40E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	7.50E–06	^{106}Rh	7.69E–09	4.38E–07	3.37E–15	1.68E–11	7.50E–06	0.00%
^{219}Rn	1.20E–09	1.8	2.16E–09	1.17E–06	^{219}Rn	1.20E–09	4.38E–07	5.25E–16	2.62E–12	1.17E–06	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	7.01E–05	^{220}Rn	7.18E–08	4.38E–07	3.15E–14	1.57E–10	7.01E–05	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	2.80E–07	^{222}Rn	2.88E–10	4.38E–07	1.26E–16	6.28E–13	2.80E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	7.50E–06	^{106}Ru	7.69E–09	4.38E–07	3.37E–15	1.68E–11	7.50E–06	0.00%
^{125}Sb	[d]		5.55E–04	3.01E–01	^{125}Sb	[e]		8.62E–10	4.30E–06	3.01E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	1.38E–03	^{126}Sb	1.41E–06	4.38E–07	6.20E–13	3.09E–09	1.38E–03	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	9.86E–03	^{126m}Sb	1.01E–05	4.38E–07	4.43E–12	2.21E–08	9.86E–03	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	1.05E–02	^{79}Se	1.07E–05	4.38E–07	4.70E–12	2.34E–08	1.05E–02	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	4.53E–09	^{146}Sm	4.65E–12	4.38E–07	2.03E–18	1.02E–14	4.53E–09	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	1.77E–07	^{147}Sm	1.81E–10	4.38E–07	7.94E–17	3.96E–13	1.77E–07	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	9.07E–13	^{148}Sm	9.30E–16	4.38E–07	4.07E–22	2.03E–18	9.07E–13	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	8.06E–14	^{149}Sm	8.26E–17	4.38E–07	3.62E–23	1.80E–19	8.06E–14	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	7.52E+00	^{151}Sm	7.71E–03	4.38E–07	3.38E–09	1.68E–05	7.52E+00	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	9.31E–12	^{119m}Sn	9.55E–15	4.38E–07	4.18E–21	2.09E–17	9.31E–12	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	5.60E–02	^{121m}Sn	5.74E–05	4.38E–07	2.51E–11	1.25E–07	5.60E–02	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	9.86E–03	^{126}Sn	1.01E–05	4.38E–07	4.43E–12	2.21E–08	9.86E–03	0.00%
^{90}Sr	[d]		1.87E–02	1.01E+01	^{90}Sr	[e]		3.34E–08	1.67E–04	1.01E+01	0.97%
^{98}Tc	6.34E–11	1.8	1.14E–10	6.19E–08	^{98}Tc	6.34E–11	4.38E–07	2.78E–17	1.39E–13	6.19E–08	0.00%
^{99}Tc	[d]		6.17E–04	3.34E–01	^{99}Tc	[e]		3.56E–10	1.78E–06	3.34E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	5.00E–14	^{123}Te	5.12E–17	4.38E–07	2.24E–23	1.12E–19	5.00E–14	0.00%
^{125m}Te	1.43E–05		1.36E–04	7.37E–02	^{125m}Te	1.43E–05	4.38E–07	6.27E–12	3.13E–08	7.37E–02	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	1.15E–06	^{227}Th	1.18E–09	4.38E–07	5.17E–16	2.58E–12	1.15E–06	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	6.99E–05	^{228}Th	7.16E–08	4.38E–07	3.14E–14	1.57E–10	6.99E–05	0.00%

Table A-5. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{229}Th	5.61E–12	1.8	1.01E–11	5.47E–09	^{229}Th	5.61E–12	4.38E–07	2.46E–18	1.23E–14	5.47E–09	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	2.30E–05	^{230}Th	2.35E–08	4.38E–07	1.03E–14	5.14E–11	2.30E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	7.73E–04	^{231}Th	7.93E–07	4.38E–07	3.47E–13	1.73E–09	7.73E–04	0.00%
^{232}Th	1.85E–14	1.8	3.33E–14	1.80E–11	^{232}Th	1.85E–14	4.38E–07	8.10E–21	4.04E–17	1.80E–11	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	7.97E–04	^{234}Th	8.17E–07	4.38E–07	3.58E–13	1.78E–09	7.97E–04	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	1.17E–06	^{207}Tl	1.19E–09	4.38E–07	5.23E–16	2.61E–12	1.17E–06	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	2.52E–05	^{208}Tl	2.58E–08	4.38E–07	1.13E–14	5.64E–11	2.52E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	1.18E–10	^{209}Tl	1.21E–13	4.38E–07	5.31E–20	2.65E–16	1.18E–10	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	4.68E–13	^{171}Tm	4.80E–16	4.38E–07	2.10E–22	1.05E–18	4.68E–13	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	6.74E–05	^{232}U	6.91E–08	4.38E–07	3.03E–14	1.51E–10	6.74E–05	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	1.73E–06	^{233}U	1.77E–09	4.38E–07	7.77E–16	3.88E–12	1.73E–06	0.00%
^{234}U	[d]		2.98E–06	1.61E–03	^{234}U	[e]		6.41E–11	3.20E–07	1.62E–03	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	7.73E–04	^{235}U	7.93E–07	4.38E–07	3.47E–13	1.73E–09	7.73E–04	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	1.80E–03	^{236}U	1.85E–06	4.38E–07	8.10E–13	4.04E–09	1.80E–03	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	2.09E–04	^{237}U	2.15E–07	4.38E–07	9.40E–14	4.69E–10	2.09E–04	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	7.97E–04	^{238}U	8.17E–07	4.38E–07	3.58E–13	1.78E–09	7.97E–04	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	2.86E–11	^{240}U	2.94E–14	4.38E–07	1.29E–20	6.42E–17	2.86E–11	0.00%
^{90}Y	[d]		1.87E–02	1.01E+01	^{90}Y	8.88E–01	4.38E–07	3.89E–07	1.94E–03	1.01E+01	0.97%
^{93}Zr	1.06E–04	1.8	1.90E–04	1.03E–01	^{93}Zr	1.06E–04	4.38E–07	4.63E–11	2.31E–07	1.03E–01	0.01%
			Total	1,046.56				Total	0.01	1,046.56	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-180.

Table A-6. Post-decontamination estimated inventory for Tank WM-181.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	2.48E–09	^{225}Ac	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	5.29E–07	^{227}Ac	1.20E–09	1.10E–05	1.31E–14	6.56E–11	5.29E–07	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	7.65E–12	^{228}Ac	1.73E–14	1.10E–05	1.90E–19	9.48E–16	7.65E–12	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	1.26E–10	^{108}Ag	2.85E–13	1.10E–05	3.13E–18	1.56E–14	1.26E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	1.42E–09	^{108m}Ag	3.20E–12	1.10E–05	3.52E–17	1.76E–13	1.42E–09	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	1.05E–14	^{109m}Ag	2.38E–17	1.10E–05	2.62E–22	1.31E–18	1.05E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	3.95E–16	^{110}Ag	8.93E–19	1.10E–05	9.82E–24	4.90E–20	3.96E–16	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	2.97E–14	^{110m}Ag	6.71E–17	1.10E–05	7.38E–22	3.68E–18	2.97E–14	0.00%
^{241}Am	[d]		3.40E–04	8.37E–02	^{241}Am	[e]		1.19E–09	5.94E–06	8.37E–02	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	3.16E–04	^{242}Am	7.13E–07	1.10E–05	7.85E–12	3.92E–08	3.16E–04	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	3.18E–04	^{242m}Am	7.17E–07	1.10E–05	7.89E–12	3.93E–08	3.18E–04	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	4.35E–04	^{243}Am	9.83E–07	1.10E–05	1.08E–11	5.40E–08	4.36E–04	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	2.48E–09	^{217}At	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{137m}Ba	[d]		9.20E–01	2.26E+02	^{137m}Ba	[e]		1.10E–05	5.49E–02	2.26E+02	47.64%
^{10}Be	7.56E–11	1.8	1.36E–10	3.35E–08	^{10}Be	7.56E–11	1.10E–05	8.32E–16	4.15E–12	3.35E–08	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	4.94E–08	^{210}Bi	1.11E–10	1.10E–05	1.23E–15	6.12E–12	4.94E–08	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	2.40E–21	^{210m}Bi	5.41E–24	1.10E–05	5.96E–29	2.97E–25	2.40E–21	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	5.30E–07	^{211}Bi	1.20E–09	1.10E–05	1.32E–14	6.57E–11	5.31E–07	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	3.18E–05	^{212}Bi	7.18E–08	1.10E–05	7.90E–13	3.94E–09	3.18E–05	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	2.48E–09	^{213}Bi	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	1.27E–07	^{214}Bi	2.88E–10	1.10E–05	3.16E–15	1.58E–11	1.27E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	9.74E–07	^{14}C	[e]		1.64E–11	8.18E–08	1.06E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	1.05E–14	^{109}Cd	2.38E–17	1.10E–05	2.62E–22	1.31E–18	1.05E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	2.56E–02	^{113m}Cd	5.78E–05	1.10E–05	6.36E–10	3.17E–06	2.56E–02	0.01%

Table A-6. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{142}Ce	7.31E–10	1.8	1.32E–09	3.24E–07	^{142}Ce	7.31E–10	1.10E–05	8.05E–15	4.01E–11	3.24E–07	0.00%
^{144}Ce	2.33E–10	1.8	4.19E–10	1.03E–07	^{144}Ce	2.33E–10	1.10E–05	2.56E–15	1.28E–11	1.03E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	3.19E–13	^{249}Cf	7.21E–16	1.10E–05	7.93E–21	3.95E–17	3.19E–13	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	1.65E–13	^{250}Cf	3.73E–16	1.10E–05	4.10E–21	2.05E–17	1.65E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	5.06E–15	^{251}Cf	1.14E–17	1.10E–05	1.26E–22	6.27E–19	5.06E–15	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	2.14E–16	^{252}Cf	4.84E–19	1.10E–05	5.33E–24	2.66E–20	2.14E–16	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	2.62E–04	^{242}Cm	5.91E–07	1.10E–05	6.50E–12	3.24E–08	2.62E–04	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	5.69E–05	^{243}Cm	1.29E–07	1.10E–05	1.41E–12	7.05E–09	5.69E–05	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	3.12E–03	^{244}Cm	7.03E–06	1.10E–05	7.74E–11	3.86E–07	3.12E–03	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	7.44E–07	^{245}Cm	1.68E–09	1.10E–05	1.85E–14	9.22E–11	7.44E–07	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	4.88E–08	^{246}Cm	1.10E–10	1.10E–05	1.21E–15	6.04E–12	4.88E–08	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	5.40E–14	^{247}Cm	1.22E–16	1.10E–05	1.34E–21	6.69E–18	5.40E–14	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	5.70E–14	^{248}Cm	1.29E–16	1.10E–05	1.42E–21	7.07E–18	5.71E–14	0.00%
^{60}Co	[d]		5.02E–05	1.24E–02	^{60}Co	[e]		2.94E–09	1.47E–05	1.24E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	1.34E–02	^{134}Cs	3.03E–05	1.10E–05	3.34E–10	1.66E–06	1.34E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	6.37E–03	^{135}Cs	1.44E–05	1.10E–05	1.58E–10	7.89E–07	6.37E–03	0.00%
^{137}Cs	[d]		9.20E–01	2.26E+02	^{137}Cs	[e]		1.10E–05	5.49E–02	2.26E+02	47.64%
^{150}Eu	2.96E–10	1.8	5.34E–10	1.31E–07	^{150}Eu	2.96E–10	1.10E–05	3.26E–15	1.63E–11	1.31E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	1.74E–02	^{152}Eu	3.92E–05	1.10E–05	4.31E–10	2.15E–06	1.74E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	7.74E–01	^{154}Eu	[e]		3.83E–09	1.91E–05	7.74E–01	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	2.10E–01	^{155}Eu	4.74E–04	1.10E–05	5.21E–09	2.60E–05	2.10E–01	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	2.16E–01	^{55}Fe	4.88E–04	1.10E–05	5.37E–09	2.68E–05	2.16E–01	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	2.48E–09	^{221}Fr	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	7.31E–09	^{223}Fr	1.65E–11	1.10E–05	1.81E–16	9.05E–13	7.31E–09	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	1.58E–14	^{152}Gd	3.58E–17	1.10E–05	3.94E–22	1.96E–18	1.58E–14	0.00%

Table A-6. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{153}Gd	4.15E–19	1.8	7.48E–19	1.84E–16	^{153}Gd	4.15E–19	1.10E–05	4.57E–24	2.28E–20	1.84E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	1.42E–01	^{3}H	[e]		1.41E–09	7.03E–06	1.42E–01	0.03%
^{166m}Ho	1.13E–09	1.8	2.03E–09	4.99E–07	^{166m}Ho	1.13E–09	1.10E–05	1.24E–14	6.18E–11	4.99E–07	0.00%
^{129}I	[d]		6.24E–07	1.54E–04	^{129}I	[e]		7.41E–11	3.70E–07	1.54E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	1.22E–13	^{115}In	2.75E–16	1.10E–05	3.03E–21	1.51E–17	1.22E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	2.07E–12	^{138}La	4.68E–15	1.10E–05	5.15E–20	2.57E–16	2.07E–12	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	3.87E–02	^{93m}Nb	8.74E–05	1.10E–05	9.61E–10	4.79E–06	3.87E–02	0.01%
^{94}Nb	[d]		1.66E–04	4.08E–02	^{94}Nb	[e]		9.92E–09	4.95E–05	4.09E–02	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	1.76E–11	^{144}Nd	3.96E–14	1.10E–05	4.36E–19	2.18E–15	1.76E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	4.99E–03	^{59}Ni	1.13E–05	1.10E–05	1.24E–10	6.18E–07	4.99E–03	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	5.68E–01	^{63}Ni	[e]		6.03E–09	3.01E–05	5.68E–01	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	9.77E–08	^{236}Np	2.21E–10	1.10E–05	2.43E–15	1.21E–11	9.77E–08	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	9.35E–03	^{237}Np	[e]		2.71E–11	1.35E–07	9.35E–03	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	1.59E–06	^{238}Np	3.58E–09	1.10E–05	3.94E–14	1.97E–10	1.59E–06	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	4.35E–04	^{239}Np	9.83E–07	1.10E–05	1.08E–11	5.40E–08	4.36E–04	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	1.30E–11	^{240m}Np	2.94E–14	1.10E–05	3.23E–19	1.61E–15	1.30E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	9.39E–07	^{231}Pa	2.12E–09	1.10E–05	2.33E–14	1.16E–10	9.39E–07	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	9.35E–03	^{233}Pa	2.11E–05	1.10E–05	2.32E–10	1.16E–06	9.35E–03	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	4.70E–07	^{234}Pa	1.06E–09	1.10E–05	1.17E–14	5.83E–11	4.70E–07	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	3.62E–04	^{234m}Pa	8.17E–07	1.10E–05	8.98E–12	4.48E–08	3.62E–04	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	2.48E–09	^{209}Pb	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	4.93E–08	^{210}Pb	1.11E–10	1.10E–05	1.23E–15	6.11E–12	4.94E–08	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	5.30E–07	^{211}Pb	1.20E–09	1.10E–05	1.32E–14	6.57E–11	5.31E–07	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	3.18E–05	^{212}Pb	7.18E–08	1.10E–05	7.90E–13	3.94E–09	3.18E–05	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	1.27E–07	^{214}Pb	2.88E–10	1.10E–05	3.16E–15	1.58E–11	1.27E–07	0.00%

Table A-6. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{107}Pd	4.06E–07	1.8	7.31E–07	1.80E–04	^{107}Pd	4.06E–07	1.10E–05	4.46E–12	2.23E–08	1.80E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	1.77E–04	^{146}Pm	4.00E–07	1.10E–05	4.40E–12	2.19E–08	1.77E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	1.72E–01	^{147}Pm	3.88E–04	1.10E–05	4.27E–09	2.13E–05	1.72E–01	0.04%
^{210}Po	1.08E–10	1.8	1.94E–10	4.77E–08	^{210}Po	1.08E–10	1.10E–05	1.18E–15	5.91E–12	4.77E–08	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	1.49E–09	^{211}Po	3.35E–12	1.10E–05	3.69E–17	1.84E–13	1.49E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	2.04E–05	^{212}Po	4.60E–08	1.10E–05	5.06E–13	2.53E–09	2.04E–05	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	2.43E–09	^{213}Po	5.49E–12	1.10E–05	6.04E–17	3.01E–13	2.43E–09	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	1.27E–07	^{214}Po	2.87E–10	1.10E–05	3.16E–15	1.58E–11	1.27E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	5.30E–07	^{215}Po	1.20E–09	1.10E–05	1.32E–14	6.57E–11	5.31E–07	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	3.18E–05	^{216}Po	7.18E–08	1.10E–05	7.90E–13	3.94E–09	3.18E–05	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	1.27E–07	^{218}Po	2.88E–10	1.10E–05	3.16E–15	1.58E–11	1.27E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	1.03E–07	^{144}Pr	2.33E–10	1.10E–05	2.56E–15	1.28E–11	1.03E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	1.24E–09	^{144m}Pr	2.79E–12	1.10E–05	3.07E–17	1.53E–13	1.24E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	2.89E–06	^{236}Pu	6.52E–09	1.10E–05	7.18E–14	3.58E–10	2.89E–06	0.00%
^{238}Pu	[d]		9.23E–03	2.27E+00	^{238}Pu	[e]		5.37E–08	2.68E–04	2.27E+00	0.48%
^{239}Pu	[d]		2.75E–03	6.77E–01	^{239}Pu	[e]		1.17E–08	5.84E–05	6.77E–01	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	2.68E–01	^{240}Pu	6.06E–04	1.10E–05	6.67E–09	3.33E–05	2.68E–01	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	3.88E+00	^{241}Pu	[e]		2.22E–07	1.11E–03	3.88E+00	0.82%
^{242}Pu	4.43E–07	1.8	7.98E–07	1.96E–04	^{242}Pu	4.43E–07	1.10E–05	4.87E–12	2.43E–08	1.96E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	5.40E–14	^{243}Pu	1.22E–16	1.10E–05	1.34E–21	6.69E–18	5.40E–14	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	1.30E–11	^{244}Pu	2.94E–14	1.10E–05	3.23E–19	1.61E–15	1.30E–11	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	5.30E–07	^{223}Ra	1.20E–09	1.10E–05	1.32E–14	6.57E–11	5.31E–07	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	3.18E–05	^{224}Ra	7.18E–08	1.10E–05	7.90E–13	3.94E–09	3.18E–05	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	2.48E–09	^{225}Ra	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	1.27E–07	^{226}Ra	2.88E–10	1.10E–05	3.16E–15	1.58E–11	1.27E–07	0.00%

Table A-6. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{228}Ra	1.73E–14	1.8	3.11E–14	7.65E–12	^{228}Ra	1.73E–14	1.10E–05	1.90E–19	9.48E–16	7.65E–12	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	3.16E–07	^{87}Rb	7.15E–10	1.10E–05	7.86E–15	3.92E–11	3.17E–07	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	1.09E–06	^{102}Rh	2.46E–09	1.10E–05	2.71E–14	1.35E–10	1.09E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	3.40E–06	^{106}Rh	7.69E–09	1.10E–05	8.45E–14	4.22E–10	3.40E–06	0.00%
^{219}Rn	1.20E–09	1.8	2.16E–09	5.30E–07	^{219}Rn	1.20E–09	1.10E–05	1.32E–14	6.57E–11	5.31E–07	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	3.18E–05	^{220}Rn	7.18E–08	1.10E–05	7.90E–13	3.94E–09	3.18E–05	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	1.27E–07	^{222}Rn	2.88E–10	1.10E–05	3.16E–15	1.58E–11	1.27E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	3.40E–06	^{106}Ru	7.69E–09	1.10E–05	8.45E–14	4.22E–10	3.40E–06	0.00%
^{125}Sb	[d]		5.55E–04	1.37E–01	^{125}Sb	[e]		1.14E–08	5.69E–05	1.37E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	6.27E–04	^{126}Sb	1.41E–06	1.10E–05	1.56E–11	7.76E–08	6.27E–04	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	4.48E–03	^{126m}Sb	1.01E–05	1.10E–05	1.11E–10	5.55E–07	4.48E–03	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	4.75E–03	^{79}Se	1.07E–05	1.10E–05	1.18E–10	5.89E–07	4.75E–03	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	2.06E–09	^{146}Sm	4.65E–12	1.10E–05	5.11E–17	2.55E–13	2.06E–09	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	8.03E–08	^{147}Sm	1.81E–10	1.10E–05	1.99E–15	9.95E–12	8.03E–08	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	4.12E–13	^{148}Sm	9.30E–16	1.10E–05	1.02E–20	5.10E–17	4.12E–13	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	3.66E–14	^{149}Sm	8.26E–17	1.10E–05	9.08E–22	4.53E–18	3.66E–14	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	3.41E+00	^{151}Sm	7.71E–03	1.10E–05	8.48E–08	4.23E–04	3.41E+00	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	4.23E–12	^{119m}Sn	9.55E–15	1.10E–05	1.05E–19	5.24E–16	4.23E–12	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	2.54E–02	^{121m}Sn	5.74E–05	1.10E–05	6.31E–10	3.15E–06	2.54E–02	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	4.48E–03	^{126}Sn	1.01E–05	1.10E–05	1.11E–10	5.55E–07	4.48E–03	0.00%
^{90}Sr	[d]		1.87E–02	4.60E+00	^{90}Sr	[e]		3.72E–07	1.86E–03	4.60E+00	0.97%
^{98}Tc	6.34E–11	1.8	1.14E–10	2.81E–08	^{98}Tc	6.34E–11	1.10E–05	6.98E–16	3.48E–12	2.81E–08	0.00%
^{99}Tc	[d]		6.17E–04	1.52E–01	^{99}Tc	[e]		2.88E–09	1.44E–05	1.52E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	2.27E–14	^{123}Te	5.12E–17	1.10E–05	5.64E–22	2.81E–18	2.27E–14	0.00%
^{125m}Te	1.43E–05		1.36E–04	3.35E–02	^{125m}Te	1.43E–05	1.10E–05	1.58E–10	7.86E–07	3.35E–02	0.01%

Table A-6. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{227}Th	1.18E–09	1.8	2.13E–09	5.23E–07	^{227}Th	1.18E–09	1.10E–05	1.30E–14	6.48E–11	5.23E–07	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	3.17E–05	^{228}Th	7.16E–08	1.10E–05	7.88E–13	3.93E–09	3.17E–05	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	2.48E–09	^{229}Th	5.61E–12	1.10E–05	6.17E–17	3.08E–13	2.48E–09	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	1.04E–05	^{230}Th	2.35E–08	1.10E–05	2.59E–13	1.29E–09	1.04E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	3.51E–04	^{231}Th	7.93E–07	1.10E–05	8.72E–12	4.35E–08	3.51E–04	0.00%
^{232}Th	1.85E–14	1.8	3.33E–14	8.19E–12	^{232}Th	1.85E–14	1.10E–05	2.04E–19	1.02E–15	8.20E–12	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	3.62E–04	^{234}Th	8.17E–07	1.10E–05	8.98E–12	4.48E–08	3.62E–04	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	5.29E–07	^{207}Tl	1.19E–09	1.10E–05	1.31E–14	6.56E–11	5.29E–07	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	1.14E–05	^{208}Tl	2.58E–08	1.10E–05	2.84E–13	1.42E–09	1.14E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	5.37E–11	^{209}Tl	1.21E–13	1.10E–05	1.33E–18	6.65E–15	5.37E–11	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	2.12E–13	^{171}Tm	4.80E–16	1.10E–05	5.28E–21	2.63E–17	2.12E–13	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	3.06E–05	^{232}U	6.91E–08	1.10E–05	7.60E–13	3.79E–09	3.06E–05	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	7.86E–07	^{233}U	1.77E–09	1.10E–05	1.95E–14	9.74E–11	7.86E–07	0.00%
^{234}U	[d]		2.98E–06	7.33E–04	^{234}U	[e]		4.45E–11	2.22E–07	7.34E–04	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	3.51E–04	^{235}U	7.93E–07	1.10E–05	8.72E–12	4.35E–08	3.51E–04	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	8.19E–04	^{236}U	1.85E–06	1.10E–05	2.03E–11	1.01E–07	8.19E–04	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	9.51E–05	^{237}U	2.15E–07	1.10E–05	2.36E–12	1.18E–08	9.51E–05	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	3.62E–04	^{238}U	8.17E–07	1.10E–05	8.98E–12	4.48E–08	3.62E–04	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	1.30E–11	^{240}U	2.94E–14	1.10E–05	3.23E–19	1.61E–15	1.30E–11	0.00%
^{90}Y	[d]		1.87E–02	4.60E+00	^{90}Y	8.88E–01	1.10E–05	9.77E–06	4.88E–02	4.65E+00	0.97%
^{93}Zr	1.06E–04	1.8	1.90E–04	4.68E–02	^{93}Zr	1.06E–04	1.10E–05	1.16E–09	5.80E–06	4.68E–02	0.01%
			Total	475.24				Total	0.12	475.4	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-181.

Table A-7. Post-decontamination estimated inventory for Tank WM-182.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	1.25E–08	^{225}Ac	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	2.66E–06	^{227}Ac	1.20E–09	2.23E–04	2.67E–13	1.33E–09	2.66E–06	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	3.85E–11	^{228}Ac	1.73E–14	2.23E–04	3.85E–18	1.92E–14	3.85E–11	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	6.35E–10	^{108}Ag	2.85E–13	2.23E–04	6.35E–17	3.17E–13	6.35E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	7.13E–09	^{108m}Ag	3.20E–12	2.23E–04	7.14E–16	3.56E–12	7.14E–09	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	5.30E–14	^{109m}Ag	2.38E–17	2.23E–04	5.30E–21	2.65E–17	5.30E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	1.99E–15	^{110}Ag	8.93E–19	2.23E–04	1.99E–22	9.93E–19	1.99E–15	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	1.50E–13	^{110m}Ag	6.71E–17	2.23E–04	1.50E–20	7.47E–17	1.50E–13	0.00%
^{241}Am	[d]		3.40E–04	4.21E–01	^{241}Am	[e]		1.06E–07	5.30E–04	4.21E–01	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	1.59E–03	^{242}Am	7.13E–07	2.23E–04	1.59E–10	7.94E–07	1.59E–03	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	1.60E–03	^{242m}Am	7.17E–07	2.23E–04	1.60E–10	7.98E–07	1.60E–03	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	2.19E–03	^{243}Am	9.83E–07	2.23E–04	2.19E–10	1.09E–06	2.19E–03	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	1.25E–08	^{217}At	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%
^{137m}Ba	[d]		9.20E–01	1.14E+03	^{137m}Ba	[e]		2.23E-04	1.11E+00	1.14E+03	47.60%
^{10}Be	7.56E–11	1.8	1.36E–10	1.69E–07	^{10}Be	7.56E–11	2.23E–04	1.69E–14	8.41E–11	1.69E–07	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	2.48E–07	^{210}Bi	1.11E–10	2.23E–04	2.49E–14	1.24E–10	2.48E–07	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	1.21E–20	^{210m}Bi	5.41E–24	2.23E–04	1.21E–27	6.02E–24	1.21E–20	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	2.67E–06	^{211}Bi	1.20E–09	2.23E–04	2.67E–13	1.33E–09	2.67E–06	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	1.60E–04	^{212}Bi	7.18E–08	2.23E–04	1.60E–11	7.99E–08	1.60E–04	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	1.25E–08	^{213}Bi	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	6.41E–07	^{214}Bi	2.88E–10	2.23E–04	6.41E–14	3.20E–10	6.41E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	4.90E–06	^{14}C	[e]		1.08E–11	5.39E–08	4.96E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	5.30E–14	^{109}Cd	2.38E–17	2.23E–04	5.30E–21	2.65E–17	5.30E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	1.29E–01	^{113m}Cd	5.78E–05	2.23E–04	1.29E–08	6.43E–05	1.29E–01	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	1.63E–06	^{142}Ce	7.31E–10	2.23E–04	1.63E–13	8.14E–10	1.63E–06	0.00%
^{144}Ce	2.33E–10	1.8	4.19E–10	5.18E–07	^{144}Ce	2.33E–10	2.23E–04	5.19E–14	2.59E–10	5.19E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	1.61E–12	^{249}Cf	7.21E–16	2.23E–04	1.61E–19	8.02E–16	1.61E–12	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	8.31E–13	^{250}Cf	3.73E–16	2.23E–04	8.32E–20	4.15E–16	8.31E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	2.55E–14	^{251}Cf	1.14E–17	2.23E–04	2.55E–21	1.27E–17	2.55E–14	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	1.08E–15	^{252}Cf	4.84E–19	2.23E–04	1.08E–22	5.39E–19	1.08E–15	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	1.32E–03	^{242}Cm	5.91E–07	2.23E–04	1.32E–10	6.58E–07	1.32E–03	0.00%

Table A-7. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{243}Cm	1.29E–07	1.8	2.31E–07	2.86E–04	^{243}Cm	1.29E–07	2.23E–04	2.87E–11	1.43E–07	2.87E–04	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	1.57E–02	^{244}Cm	7.03E–06	2.23E–04	1.57E–09	7.82E–06	1.57E–02	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	3.74E–06	^{245}Cm	1.68E–09	2.23E–04	3.75E–13	1.87E–09	3.75E–06	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	2.45E–07	^{246}Cm	1.10E–10	2.23E–04	2.46E–14	1.23E–10	2.46E–07	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	2.72E–13	^{247}Cm	1.22E–16	2.23E–04	2.72E–20	1.36E–16	2.72E–13	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	2.87E–13	^{248}Cm	1.29E–16	2.23E–04	2.87E–20	1.43E–16	2.87E–13	0.00%
^{60}Co	[d]		5.02E–05	6.21E–02	^{60}Co	3.70E–04	2.23E–04	8.26E–08	4.12E–04	6.26E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	6.76E–02	^{134}Cs	3.03E–05	2.23E–04	6.76E–09	3.37E–05	6.76E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	3.20E–02	^{135}Cs	1.44E–05	2.23E–04	3.21E–09	1.60E–05	3.21E–02	0.00%
^{137}Cs	[d]		9.20E–01	1.14E+03	^{137}Cs	[e]		2.23E–04	1.11E+00	1.14E+03	47.65%
^{150}Eu	2.96E–10	1.8	5.34E–10	6.61E–07	^{150}Eu	2.96E–10	2.23E–04	6.61E–14	3.30E–10	6.61E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	8.73E–02	^{152}Eu	3.92E–05	2.23E–04	8.74E–09	4.36E–05	8.74E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	3.89E+00	^{154}Eu	[e]		6.40E–08	3.19E–04	3.89E+00	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	1.06E+00	^{155}Eu	4.74E–04	2.23E–04	1.06E–07	5.27E–04	1.06E+00	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	1.09E+00	^{55}Fe	4.88E–04	2.23E–04	1.09E–07	5.43E–04	1.09E+00	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	1.25E–08	^{221}Fr	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	3.68E–08	^{223}Fr	1.65E–11	2.23E–04	3.68E–15	1.84E–11	3.68E–08	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	7.97E–14	^{152}Gd	3.58E–17	2.23E–04	7.98E–21	3.98E–17	7.98E–14	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	9.26E–16	^{153}Gd	4.15E–19	2.23E–04	9.26E–23	4.62E–19	9.26E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	7.17E–01	^{3}H	[e]		3.33E–09	1.66E–05	7.17E–01	0.03%
^{166m}Ho	1.13E–09	1.8	2.03E–09	2.51E–06	^{166m}Ho	1.13E–09	2.23E–04	2.51E–13	1.25E–09	2.51E–06	0.00%
^{129}I	[d]		6.24E–07	7.73E–04	^{129}I	[e]		2.25E–10	1.12E–06	7.74E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	6.13E–13	^{115}In	2.75E–16	2.23E–04	6.13E–20	3.06E–16	6.13E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	1.04E–11	^{138}La	4.68E–15	2.23E–04	1.04E–18	5.21E–15	1.04E–11	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	1.95E–01	^{93m}Nb	8.74E–05	2.23E–04	1.95E–08	9.72E–05	1.95E–01	0.01%
^{94}Nb	[d]		1.66E–04	2.06E–01	^{94}Nb	3.62E–05	2.23E–04	8.07E–09	4.03E–05	2.06E–01	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	8.83E–11	^{144}Nd	3.96E–14	2.23E–04	8.84E–18	4.41E–14	8.84E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	2.51E–02	^{59}Ni	1.13E–05	2.23E–04	2.51E–09	1.25E–05	2.51E–02	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	2.86E+00	^{63}Ni	1.28E–03	2.23E–04	2.86E–07	1.43E–03	2.86E+00	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	4.91E–07	^{236}Np	2.21E–10	2.23E–04	4.92E–14	2.45E–10	4.92E–07	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	4.70E–02	^{237}Np	[e]		5.44E–11	2.71E–07	4.70E–02	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	7.99E–06	^{238}Np	3.58E–09	2.23E–04	7.99E–13	3.99E–09	7.99E–06	0.00%

Table A-7. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{239}Np	9.83E–07	1.8	1.77E–06	2.19E–03	^{239}Np	9.83E–07	2.23E–04	2.19E–10	1.09E–06	2.19E–03	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	6.54E–11	^{240m}Np	2.94E–14	2.23E–04	6.55E–18	3.27E–14	6.55E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	4.73E–06	^{231}Pa	2.12E–09	2.23E–04	4.73E–13	2.36E–09	4.73E–06	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	4.70E–02	^{233}Pa	2.11E–05	2.23E–04	4.71E–09	2.35E–05	4.70E–02	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	2.37E–06	^{234}Pa	1.06E–09	2.23E–04	2.37E–13	1.18E–09	2.37E–06	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	1.82E–03	^{234m}Pa	8.17E–07	2.23E–04	1.82E–10	9.09E–07	1.82E–03	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	1.25E–08	^{209}Pb	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	2.48E–07	^{210}Pb	1.11E–10	2.23E–04	2.48E–14	1.24E–10	2.48E–07	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	2.67E–06	^{211}Pb	1.20E–09	2.23E–04	2.67E–13	1.33E–09	2.67E–06	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	1.60E–04	^{212}Pb	7.18E–08	2.23E–04	1.60E–11	7.99E–08	1.60E–04	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	6.41E–07	^{214}Pb	2.88E–10	2.23E–04	6.41E–14	3.20E–10	6.41E–07	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	9.05E–04	^{107}Pd	4.06E–07	2.23E–04	9.05E–11	4.52E–07	9.05E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	8.91E–04	^{146}Pm	4.00E–07	2.23E–04	8.92E–11	4.45E–07	8.92E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	8.65E–01	^{147}Pm	3.88E–04	2.23E–04	8.66E–08	4.32E–04	8.66E–01	0.04%
^{210}Po	1.08E–10	1.8	1.94E–10	2.40E–07	^{210}Po	1.08E–10	2.23E–04	2.40E–14	1.20E–10	2.40E–07	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	7.47E–09	^{211}Po	3.35E–12	2.23E–04	7.48E–16	3.73E–12	7.48E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	1.03E–04	^{212}Po	4.60E–08	2.23E–04	1.03E–11	5.12E–08	1.03E–04	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	1.22E–08	^{213}Po	5.49E–12	2.23E–04	1.22E–15	6.11E–12	1.22E–08	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	6.41E–07	^{214}Po	2.87E–10	2.23E–04	6.41E–14	3.20E–10	6.41E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	2.67E–06	^{215}Po	1.20E–09	2.23E–04	2.67E–13	1.33E–09	2.67E–06	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	1.60E–04	^{216}Po	7.18E–08	2.23E–04	1.60E–11	7.99E–08	1.60E–04	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	6.41E–07	^{218}Po	2.88E–10	2.23E–04	6.41E–14	3.20E–10	6.41E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	5.18E–07	^{144}Pr	2.33E–10	2.23E–04	5.19E–14	2.59E–10	5.19E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	6.22E–09	^{144m}Pr	2.79E–12	2.23E–04	6.23E–16	3.11E–12	6.22E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	1.45E–05	^{236}Pu	6.52E–09	2.23E–04	1.45E–12	7.26E–09	1.45E–05	0.00%
^{238}Pu	[d]		9.23E–03	1.14E+01	^{238}Pu	[e]		4.96E–07	2.47E–03	1.14E+01	0.48%
^{239}Pu	[d]		2.75E–03	3.40E+00	^{239}Pu	[e]		4.90E–08	2.44E–04	3.40E+00	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	1.35E+00	^{240}Pu	6.06E–04	2.23E–04	1.35E–07	6.74E–04	1.35E+00	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	1.95E+01	^{241}Pu	[e]		1.18E–07	5.89E–04	1.95E+01	0.81%
^{242}Pu	4.43E–07	1.8	7.98E–07	9.87E–04	^{242}Pu	4.43E–07	2.23E–04	9.88E–11	4.93E–07	9.88E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	2.72E–13	^{243}Pu	1.22E–16	2.23E–04	2.72E–20	1.36E–16	2.72E–13	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	6.55E–11	^{244}Pu	2.94E–14	2.23E–04	6.56E–18	3.27E–14	6.55E–11	0.00%

Table A-7. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{223}Ra	1.20E–09	1.8	2.16E–09	2.67E–06	^{223}Ra	1.20E–09	2.23E–04	2.67E–13	1.33E–09	2.67E–06	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	1.60E–04	^{224}Ra	7.18E–08	2.23E–04	1.60E–11	7.99E–08	1.60E–04	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	1.25E–08	^{225}Ra	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	6.41E–07	^{226}Ra	2.88E–10	2.23E–04	6.41E–14	3.20E–10	6.41E–07	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	3.85E–11	^{228}Ra	1.73E–14	2.23E–04	3.85E–18	1.92E–14	3.85E–11	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	1.59E–06	^{87}Rb	7.15E–10	2.23E–04	1.59E–13	7.95E–10	1.59E–06	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	5.49E–06	^{102}Rh	2.46E–09	2.23E–04	5.50E–13	2.74E–09	5.49E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	1.71E–05	^{106}Rh	7.69E–09	2.23E–04	1.71E–12	8.55E–09	1.71E–05	0.00%
^{219}Rn	1.20E–09	1.8	2.16E–09	2.67E–06	^{219}Rn	1.20E–09	2.23E–04	2.67E–13	1.33E–09	2.67E–06	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	1.60E–04	^{220}Rn	7.18E–08	2.23E–04	1.60E–11	7.99E–08	1.60E–04	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	6.41E–07	^{222}Rn	2.88E–10	2.23E–04	6.41E–14	3.20E–10	6.41E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	1.71E–05	^{106}Ru	7.69E–09	2.23E–04	1.71E–12	8.55E–09	1.71E–05	0.00%
^{125}Sb	[d]		5.55E–04	6.87E–01	^{125}Sb	[e]		3.53E–07	1.76E–03	6.89E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	3.15E–03	^{126}Sb	1.41E–06	2.23E–04	3.15E–10	1.57E–06	3.15E–03	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	2.25E–02	^{126m}Sb	1.01E–05	2.23E–04	2.25E–09	1.12E–05	2.25E–02	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	2.39E–02	^{79}Se	1.07E–05	2.23E–04	2.39E–09	1.19E–05	2.39E–02	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	1.04E–08	^{146}Sm	4.65E–12	2.23E–04	1.04E–15	5.17E–12	1.04E–08	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	4.04E–07	^{147}Sm	1.81E–10	2.23E–04	4.04E–14	2.02E–10	4.04E–07	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	2.07E–12	^{148}Sm	9.30E–16	2.23E–04	2.07E–19	1.03E–15	2.07E–12	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	1.84E–13	^{149}Sm	8.26E–17	2.23E–04	1.84E–20	9.19E–17	1.84E–13	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	1.72E+01	^{151}Sm	7.71E–03	2.23E–04	1.72E–06	8.57E–03	1.72E+01	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	2.13E–11	^{119m}Sn	9.55E–15	2.23E–04	2.13E–18	1.06E–14	2.13E–11	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	1.28E–01	^{121m}Sn	5.74E–05	2.23E–04	1.28E–08	6.38E–05	1.28E–01	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	2.25E–02	^{126}Sn	1.01E–05	2.23E–04	2.25E–09	1.12E–05	2.25E–02	0.00%
^{90}Sr	[d]		1.87E–02	2.32E+01	^{90}Sr	[e]		4.83E–05	2.41E–01	2.34E+01	0.98%
^{98}Tc	6.34E–11	1.8	1.14E–10	1.41E–07	^{98}Tc	6.34E–11	2.23E–04	1.41E–14	7.06E–11	1.41E–07	0.00%
^{99}Tc	[d]		6.17E–04	7.64E–01	^{99}Tc	[e]		9.11E–09	4.54E–05	7.64E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	1.14E–13	^{123}Te	5.12E–17	2.23E–04	1.14E–20	5.70E–17	1.14E–13	0.00%
^{125m}Te	1.43E–05		1.36E–04	1.68E–01	^{125m}Te	1.43E–05	2.23E–04	3.19E–09	1.59E–05	1.68E–01	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	2.63E–06	^{227}Th	1.18E–09	2.23E–04	2.63E–13	1.31E–09	2.63E–06	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	1.60E–04	^{228}Th	7.16E–08	2.23E–04	1.60E–11	7.97E–08	1.60E–04	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	1.25E–08	^{229}Th	5.61E–12	2.23E–04	1.25E–15	6.24E–12	1.25E–08	0.00%

Table A-7. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{230}Th	2.35E–08	1.8	4.24E–08	5.24E–05	^{230}Th	2.35E–08	2.23E–04	5.25E–12	2.62E–08	5.25E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	1.77E–03	^{231}Th	7.93E–07	2.23E–04	1.77E–10	8.82E–07	1.77E–03	0.00%
^{232}Th	1.85E–14	1.8	3.33E–14	4.12E–11	^{232}Th	1.85E–14	2.23E–04	4.13E–18	2.06E–14	4.12E–11	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	1.82E–03	^{234}Th	8.17E–07	2.23E–04	1.82E–10	9.09E–07	1.82E–03	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	2.66E–06	^{207}Tl	1.19E–09	2.23E–04	2.66E–13	1.33E–09	2.66E–06	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	5.75E–05	^{208}Tl	2.58E–08	2.23E–04	5.76E–12	2.87E–08	5.75E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	2.70E–10	^{209}Tl	1.21E–13	2.23E–04	2.70E–17	1.35E–13	2.70E–10	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	1.07E–12	^{171}Tm	4.80E–16	2.23E–04	1.07E–19	5.34E–16	1.07E–12	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	1.54E–04	^{232}U	6.91E–08	2.23E–04	1.54E–11	7.69E–08	1.54E–04	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	3.95E–06	^{233}U	1.77E–09	2.23E–04	3.96E–13	1.97E–09	3.96E–06	0.00%
^{234}U	[d]		2.98E–06	3.69E–03	^{234}U	[e]		6.18E–10	3.08E–06	3.69E–03	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	1.77E–03	^{235}U	7.93E–07	2.23E–04	1.77E–10	8.82E–07	1.77E–03	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	4.12E–03	^{236}U	1.85E–06	2.23E–04	4.12E–10	2.06E–06	4.12E–03	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	4.78E–04	^{237}U	2.15E–07	2.23E–04	4.79E–11	2.39E–07	4.79E–04	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	1.82E–03	^{238}U	8.17E–07	2.23E–04	1.82E–10	9.09E–07	1.82E–03	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	6.54E–11	^{240}U	2.94E–14	2.23E–04	6.55E–18	3.27E–14	6.55E–11	0.00%
^{90}Y	[d]		1.87E–02	2.32E+01	^{90}Y	[e]		4.83E–05	2.41E–01	2.34E+01	0.98%
^{93}Zr	1.06E–04	1.8	1.90E–04	2.36E–01	^{93}Zr	1.06E–04	2.23E–04	2.36E–08	1.18E–04	2.36E–01	0.01%
			Total	2,391				Total	3	2,394	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-182.

Table A-8. Post-decontamination estimated inventory for Tank WM-183.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	7.08E–09	^{225}Ac	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	1.51E–06	^{227}Ac	1.20E–09	8.38E–05	1.00E–13	5.00E–10	1.51E–06	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	2.18E–11	^{228}Ac	1.73E–14	8.38E–05	1.45E–18	7.22E–15	2.18E–11	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	3.60E–10	^{108}Ag	2.85E–13	8.38E–05	2.39E–17	1.19E–13	3.60E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	4.04E–09	^{108m}Ag	3.20E–12	8.38E–05	2.68E–16	1.34E–12	4.05E–09	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	3.00E–14	^{109m}Ag	2.38E–17	8.38E–05	1.99E–21	9.94E–18	3.00E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	1.13E–15	^{110}Ag	8.93E–19	8.38E–05	7.48E–23	3.73E–19	1.13E–15	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	8.48E–14	^{110m}Ag	6.71E–17	8.38E–05	5.63E–21	2.81E–17	8.48E–14	0.00%
^{241}Am	[d]		3.40E–04	2.39E–01	^{241}Am	[e]		1.94E–07	9.68E–04	2.40E–01	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	9.01E–04	^{242}Am	7.13E–07	8.38E–05	5.98E–11	2.98E–07	9.01E–04	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	9.06E–04	^{242m}Am	7.17E–07	8.38E–05	6.01E–11	3.00E–07	9.06E–04	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	1.24E–03	^{243}Am	9.83E–07	8.38E–05	8.24E–11	4.11E–07	1.24E–03	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	7.08E–09	^{217}At	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{137m}Ba	[d]		9.20E–01	6.46E+02	^{137m}Ba	[e]		8.38E–05	4.18E–01	6.46E+02	47.39%
^{10}Be	7.56E–11	1.8	1.36E–10	9.55E–08	^{10}Be	7.56E–11	8.38E–05	6.34E–15	3.16E–11	9.56E–08	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	1.41E–07	^{210}Bi	1.11E–10	8.38E–05	9.34E–15	4.66E–11	1.41E–07	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	6.84E–21	^{210m}Bi	5.41E–24	8.38E–05	4.54E–28	2.26E–24	6.84E–21	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	1.51E–06	^{211}Bi	1.20E–09	8.38E–05	1.00E–13	5.01E–10	1.51E–06	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	9.07E–05	^{212}Bi	7.18E–08	8.38E–05	6.02E–12	3.00E–08	9.08E–05	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	7.08E–09	^{213}Bi	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	3.63E–07	^{214}Bi	2.88E–10	8.38E–05	2.41E–14	1.20E–10	3.63E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	2.78E–06	^{14}C	[e]		1.72E–11	8.58E–08	2.86E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	3.00E–14	^{109}Cd	2.38E–17	8.38E–05	1.99E–21	9.94E–18	3.00E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	7.30E–02	^{113m}Cd	5.78E–05	8.38E–05	4.84E–09	2.42E–05	7.30E–02	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	9.24E–07	^{142}Ce	7.31E–10	8.38E–05	6.13E–14	3.06E–10	9.24E–07	0.00%
^{144}Ce	2.33E–10	1.8	4.19E–10	2.94E–07	^{144}Ce	2.33E–10	8.38E–05	1.95E–14	9.73E–11	2.94E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	9.10E–13	^{249}Cf	7.21E–16	8.38E–05	6.04E–20	3.01E–16	9.10E–13	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	4.71E–13	^{250}Cf	3.73E–16	8.38E–05	3.12E–20	1.56E–16	4.71E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	1.44E–14	^{251}Cf	1.14E–17	8.38E–05	9.57E–22	4.78E–18	1.44E–14	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	6.12E–16	^{252}Cf	4.84E–19	8.38E–05	4.06E–23	2.02E–19	6.12E–16	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	7.47E–04	^{242}Cm	5.91E–07	8.38E–05	4.96E–11	2.47E–07	7.47E–04	0.00%

Table A-8. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{243}Cm	1.29E–07	1.8	2.31E–07	1.62E–04	^{243}Cm	1.29E–07	8.38E–05	1.08E–11	5.37E–08	1.62E–04	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	8.88E–03	^{244}Cm	[e]		3.25E–09	1.62E–05	8.90E–03	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	2.12E–06	^{245}Cm	1.68E–09	8.38E–05	1.41E–13	7.02E–10	2.12E–06	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	1.39E–07	^{246}Cm	1.10E–10	8.38E–05	9.23E–15	4.61E–11	1.39E–07	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	1.54E–13	^{247}Cm	1.22E–16	8.38E–05	1.02E–20	5.10E–17	1.54E–13	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	1.63E–13	^{248}Cm	1.29E–16	8.38E–05	1.08E–20	5.38E–17	1.63E–13	0.00%
^{60}Co	[d]		5.02E–05	3.52E–02	^{60}Co	[e]		2.66E–09	1.33E–05	3.52E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	3.83E–02	^{134}Cs	3.03E–05	8.38E–05	2.54E–09	1.27E–05	3.83E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	1.82E–02	^{135}Cs	1.44E–05	8.38E–05	1.21E–09	6.01E–06	1.82E–02	0.00%
^{137}Cs	[d]		9.20E–01	6.46E+02	^{137}Cs	[e]		8.38E–05	4.18E–01	6.46E+02	47.39%
^{150}Eu	2.96E–10	1.8	5.34E–10	3.74E–07	^{150}Eu	2.96E–10	8.38E–05	2.48E–14	1.24E–10	3.75E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	4.95E–02	^{152}Eu	3.92E–05	8.38E–05	3.28E–09	1.64E–05	4.95E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	2.21E+00	^{154}Eu	[e]		6.35E–09	3.17E–05	2.21E+00	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	5.98E–01	^{155}Eu	4.74E–04	8.38E–05	3.97E–08	1.98E–04	5.98E–01	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	6.16E–01	^{55}Fe	4.88E–04	8.38E–05	4.09E–08	2.04E–04	6.17E–01	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	7.08E–09	^{221}Fr	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	2.08E–08	^{223}Fr	1.65E–11	8.38E–05	1.38E–15	6.90E–12	2.08E–08	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	4.52E–14	^{152}Gd	3.58E–17	8.38E–05	3.00E–21	1.50E–17	4.52E–14	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	5.25E–16	^{153}Gd	4.15E–19	8.38E–05	3.48E–23	1.74E–19	5.25E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	4.06E–01	^{3}H	[e]		3.87E–07	1.93E–03	4.08E–01	0.03%
^{166m}Ho	1.13E–09	1.8	2.03E–09	1.42E–06	^{166m}Ho	1.13E–09	8.38E–05	9.44E–14	4.71E–10	1.42E–06	0.00%
^{129}I	[d]		6.24E–07	4.38E–04	^{129}I	[e]		1.53E–09	7.63E–06	4.46E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	3.47E–13	^{115}In	2.75E–16	8.38E–05	2.30E–20	1.15E–16	3.48E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	5.92E–12	^{138}La	4.68E–15	8.38E–05	3.93E–19	1.96E–15	5.92E–12	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	1.10E–01	^{93m}Nb	8.74E–05	8.38E–05	7.32E–09	3.65E–05	1.10E–01	0.01%
^{94}Nb	[d]		1.66E–04	1.16E–01	^{94}Nb	[e]		1.09E–08	5.44E–05	1.17E–01	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	5.01E–11	^{144}Nd	3.96E–14	8.38E–05	3.32E–18	1.66E–14	5.01E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	1.42E–02	^{59}Ni	1.13E–05	8.38E–05	9.44E–10	4.71E–06	1.42E–02	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	1.62E+00	^{63}Ni	[e]		2.84E–07	1.42E–03	1.62E+00	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	2.79E–07	^{236}Np	2.21E–10	8.38E–05	1.85E–14	9.22E–11	2.79E–07	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	2.67E–02	^{237}Np	[e]		3.12E–09	1.56E–05	2.67E–02	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	4.53E–06	^{238}Np	3.58E–09	8.38E–05	3.00E–13	1.50E–09	4.53E–06	0.00%

Table A-8. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{239}Np	9.83E–07	1.8	1.77E–06	1.24E–03	^{239}Np	9.83E–07	8.38E–05	8.24E–11	4.11E–07	1.24E–03	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	3.71E–11	^{240m}Np	2.94E–14	8.38E–05	2.46E–18	1.23E–14	3.71E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	2.68E–06	^{231}Pa	2.12E–09	8.38E–05	1.78E–13	8.87E–10	2.68E–06	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	2.67E–02	^{233}Pa	2.11E–05	8.38E–05	1.77E–09	8.82E–06	2.67E–02	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	1.34E–06	^{234}Pa	1.06E–09	8.38E–05	8.89E–14	4.44E–10	1.34E–06	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	1.03E–03	^{234m}Pa	8.17E–07	8.38E–05	6.84E–11	3.41E–07	1.03E–03	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	7.08E–09	^{209}Pb	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	1.41E–07	^{210}Pb	1.11E–10	8.38E–05	9.34E–15	4.66E–11	1.41E–07	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	1.51E–06	^{211}Pb	1.20E–09	8.38E–05	1.00E–13	5.01E–10	1.51E–06	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	9.07E–05	^{212}Pb	7.18E–08	8.38E–05	6.02E–12	3.00E–08	9.08E–05	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	3.63E–07	^{214}Pb	2.88E–10	8.38E–05	2.41E–14	1.20E–10	3.63E–07	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	5.13E–04	^{107}Pd	4.06E–07	8.38E–05	3.40E–11	1.70E–07	5.13E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	5.05E–04	^{146}Pm	4.00E–07	8.38E–05	3.35E–11	1.67E–07	5.05E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	4.91E–01	^{147}Pm	3.88E–04	8.38E–05	3.25E–08	1.62E–04	4.91E–01	0.04%
^{210}Po	1.08E–10	1.8	1.94E–10	1.36E–07	^{210}Po	1.08E–10	8.38E–05	9.02E–15	4.50E–11	1.36E–07	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	4.24E–09	^{211}Po	3.35E–12	8.38E–05	2.81E–16	1.40E–12	4.24E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	5.81E–05	^{212}Po	4.60E–08	8.38E–05	3.86E–12	1.92E–08	5.82E–05	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	6.93E–09	^{213}Po	5.49E–12	8.38E–05	4.60E–16	2.29E–12	6.93E–09	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	3.63E–07	^{214}Po	2.87E–10	8.38E–05	2.41E–14	1.20E–10	3.63E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	1.51E–06	^{215}Po	1.20E–09	8.38E–05	1.00E–13	5.01E–10	1.51E–06	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	9.07E–05	^{216}Po	7.18E–08	8.38E–05	6.02E–12	3.00E–08	9.08E–05	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	3.63E–07	^{218}Po	2.88E–10	8.38E–05	2.41E–14	1.20E–10	3.63E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	2.94E–07	^{144}Pr	2.33E–10	8.38E–05	1.95E–14	9.73E–11	2.94E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	3.53E–09	^{144m}Pr	2.79E–12	8.38E–05	2.34E–16	1.17E–12	3.53E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	8.24E–06	^{236}Pu	6.52E–09	8.38E–05	5.47E–13	2.73E–09	8.24E–06	0.00%
^{238}Pu	[d]		9.23E–03	6.48E+00	^{238}Pu	[e]		9.59E–07	4.78E–03	6.48E+00	0.48%
^{239}Pu	[d]		2.75E–03	1.93E+00	^{239}Pu	[e]		3.37E–07	1.68E–03	1.93E+00	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	7.65E–01	^{240}Pu	6.06E–04	8.38E–05	5.08E–08	2.53E–04	7.66E–01	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	1.11E+01	^{241}Pu	[e]		8.75E–08	4.37E–04	1.11E+01	0.81%
^{242}Pu	4.43E–07	1.8	7.98E–07	5.60E–04	^{242}Pu	4.43E–07	8.38E–05	3.71E–11	1.85E–07	5.60E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	1.54E–13	^{243}Pu	1.22E–16	8.38E–05	1.02E–20	5.10E–17	1.54E–13	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	3.71E–11	^{244}Pu	2.94E–14	8.38E–05	2.46E–18	1.23E–14	3.71E–11	0.00%

Table A-8. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{223}Ra	1.20E–09	1.8	2.16E–09	1.51E–06	^{223}Ra	1.20E–09	8.38E–05	1.00E–13	5.01E–10	1.51E–06	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	9.07E–05	^{224}Ra	7.18E–08	8.38E–05	6.02E–12	3.00E–08	9.08E–05	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	7.08E–09	^{225}Ra	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	3.63E–07	^{226}Ra	2.88E–10	8.38E–05	2.41E–14	1.20E–10	3.63E–07	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	2.18E–11	^{228}Ra	1.73E–14	8.38E–05	1.45E–18	7.22E–15	2.18E–11	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	9.03E–07	^{87}Rb	7.15E–10	8.38E–05	5.99E–14	2.99E–10	9.03E–07	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	3.11E–06	^{102}Rh	2.46E–09	8.38E–05	2.06E–13	1.03E–09	3.11E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	9.71E–06	^{106}Rh	7.69E–09	8.38E–05	6.44E–13	3.21E–09	9.71E–06	0.00%
^{219}Rn	1.20E–09	1.8	2.16E–09	1.51E–06	^{219}Rn	1.20E–09	8.38E–05	1.00E–13	5.01E–10	1.51E–06	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	9.07E–05	^{220}Rn	7.18E–08	8.38E–05	6.02E–12	3.00E–08	9.08E–05	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	3.63E–07	^{222}Rn	2.88E–10	8.38E–05	2.41E–14	1.20E–10	3.63E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	9.71E–06	^{106}Ru	7.69E–09	8.38E–05	6.44E–13	3.21E–09	9.71E–06	0.00%
^{125}Sb	[d]		5.55E–04	3.89E–01	^{125}Sb	[e]		3.34E–08	1.67E–04	3.90E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	1.79E–03	^{126}Sb	1.41E–06	8.38E–05	1.19E–10	5.91E–07	1.79E–03	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	1.28E–02	^{126m}Sb	1.01E–05	8.38E–05	8.47E–10	4.22E–06	1.28E–02	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	1.36E–02	^{79}Se	1.07E–05	8.38E–05	8.99E–10	4.49E–06	1.36E–02	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	5.87E–09	^{146}Sm	4.65E–12	8.38E–05	3.89E–16	1.94E–12	5.87E–09	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	2.29E–07	^{147}Sm	1.81E–10	8.38E–05	1.52E–14	7.58E–11	2.29E–07	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	1.17E–12	^{148}Sm	9.30E–16	8.38E–05	7.79E–20	3.89E–16	1.18E–12	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	1.04E–13	^{149}Sm	8.26E–17	8.38E–05	6.92E–21	3.45E–17	1.04E–13	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	9.73E+00	^{151}Sm	7.71E–03	8.38E–05	6.46E–07	3.22E–03	9.74E+00	0.71%
^{119m}Sn	9.55E–15	1.8	1.72E–14	1.21E–11	^{119m}Sn	9.55E–15	8.38E–05	8.00E–19	3.99E–15	1.21E–11	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	7.25E–02	^{121m}Sn	5.74E–05	8.38E–05	4.81E–09	2.40E–05	7.25E–02	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	1.28E–02	^{126}Sn	1.01E–05	8.38E–05	8.47E–10	4.22E–06	1.28E–02	0.00%
^{90}Sr	[d]		1.87E–02	1.31E+01	^{90}Sr	[e]		7.00E–04	3.49E+00	1.66E+01	1.22%
^{98}Tc	6.34E–11	1.8	1.14E–10	8.01E–08	^{98}Tc	6.34E–11	8.38E–05	5.32E–15	2.65E–11	8.02E–08	0.00%
^{99}Tc	[d]		6.17E–04	4.33E–01	^{99}Tc	[e]		1.75E–09	8.73E–06	4.33E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	6.47E–14	^{123}Te	5.12E–17	8.38E–05	4.29E–21	2.14E–17	6.47E–14	0.00%
^{125m}Te	1.43E–05		1.36E–04	9.54E–02	^{125m}Te	1.43E–05	8.38E–05	1.20E–09	5.99E–06	9.54E–02	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	1.49E–06	^{227}Th	1.18E–09	8.38E–05	9.90E–14	4.94E–10	1.49E–06	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	9.05E–05	^{228}Th	7.16E–08	8.38E–05	6.00E–12	2.99E–08	9.05E–05	0.00%

Table A-8. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{229}Th	5.61E–12	1.8	1.01E–11	7.08E–09	^{229}Th	5.61E–12	8.38E–05	4.70E–16	2.34E–12	7.09E–09	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	2.97E–05	^{230}Th	2.35E–08	8.38E–05	1.97E–12	9.84E–09	2.97E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	1.00E–03	^{231}Th	7.93E–07	8.38E–05	6.64E–11	3.31E–07	1.00E–03	0.00%
^{232}Th	1.85E–14	1.8	3.33E–14	2.34E–11	^{232}Th	1.85E–14	8.38E–05	1.55E–18	7.73E–15	2.34E–11	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	1.03E–03	^{234}Th	8.17E–07	8.38E–05	6.84E–11	3.41E–07	1.03E–03	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	1.51E–06	^{207}Tl	1.19E–09	8.38E–05	1.00E–13	4.99E–10	1.51E–06	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	3.26E–05	^{208}Tl	2.58E–08	8.38E–05	2.16E–12	1.08E–08	3.26E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	1.53E–10	^{209}Tl	1.21E–13	8.38E–05	1.02E–17	5.06E–14	1.53E–10	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	6.06E–13	^{171}Tm	4.80E–16	8.38E–05	4.02E–20	2.01E–16	6.06E–13	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	8.73E–05	^{232}U	6.91E–08	8.38E–05	5.79E–12	2.89E–08	8.73E–05	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	2.24E–06	^{233}U	1.77E–09	8.38E–05	1.49E–13	7.42E–10	2.24E–06	0.00%
^{234}U	[d]		2.98E–06	2.09E–03	^{234}U	[e]		1.64E–09	8.18E–06	2.10E–03	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	1.00E–03	^{235}U	[e]		1.06E–10	5.29E–07	1.00E–03	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	2.34E–03	^{236}U	1.85E–06	8.38E–05	1.55E–10	7.73E–07	2.34E–03	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	2.71E–04	^{237}U	2.15E–07	8.38E–05	1.80E–11	8.98E–08	2.71E–04	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	1.03E–03	^{238}U	[e]		7.40E–11	3.69E–07	1.03E–03	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	3.71E–11	^{240}U	2.94E–14	8.38E–05	2.46E–18	1.23E–14	3.71E–11	0.00%
^{90}Y	[d]		1.87E–02	1.31E+01	^{90}Y	8.88E–01	8.38E–05	7.44E–05	3.71E–01	1.35E+01	1.22%
^{93}Zr	1.06E–04	1.8	1.90E–04	1.34E–01	^{93}Zr	1.06E–04	8.38E–05	8.86E–09	4.42E–05	1.34E–01	0.01%
			Total	1,355				Total	8	1,363	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-183.

Table A-9. Post-decontamination estimated inventory for Tank WM-184.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	5.63E–09	^{225}Ac	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	1.20E–06	^{227}Ac	1.20E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	1.73E–11	^{228}Ac	1.73E–14	2.04E–05	3.52E–19	1.76E–15	1.73E–11	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	2.86E–10	^{108}Ag	2.85E–13	2.04E–05	5.81E–18	2.90E–14	2.86E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	3.21E–09	^{108m}Ag	[e]		2.06E–09	1.03E–05	1.03E–05	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	2.39E–14	^{109m}Ag	2.38E–17	2.04E–05	4.85E–22	2.42E–18	2.39E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	8.96E–16	^{110}Ag	8.93E–19	2.04E–05	1.82E–23	9.09E–20	8.96E–16	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	6.74E–14	^{110m}Ag	6.71E–17	2.04E–05	1.37E–21	6.83E–18	6.74E–14	0.00%
^{241}Am	[d]		3.40E–04	1.90E–01	^{241}Am	[e]		2.12E–08	1.06E–04	1.90E–01	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	7.16E–04	^{242}Am	7.13E–07	2.04E–05	1.46E–11	7.26E–08	7.16E–04	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	7.20E–04	^{242m}Am	7.17E–07	2.04E–05	1.46E–11	7.30E–08	7.20E–04	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	9.87E–04	^{243}Am	9.83E–07	2.04E–05	2.01E–11	1.00E–07	9.87E–04	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	5.63E–09	^{217}At	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{137m}Ba	[d]		9.20E–01	5.13E+02	^{137m}Ba	[e]		2.04E–05	1.02E–01	5.13E+02	47.63%
^{10}Be	7.56E–11	1.8	1.36E–10	7.59E–08	^{10}Be	7.56E–11	2.04E–05	1.54E–15	7.70E–12	7.59E–08	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	1.12E–07	^{210}Bi	1.11E–10	2.04E–05	2.27E–15	1.13E–11	1.12E–07	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	5.43E–21	^{210m}Bi	5.41E–24	2.04E–05	1.10E–28	5.51E–25	5.43E–21	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	1.20E–06	^{211}Bi	1.20E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	7.21E–05	^{212}Bi	7.18E–08	2.04E–05	1.47E–12	7.31E–09	7.21E–05	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	5.63E–09	^{213}Bi	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	2.89E–07	^{214}Bi	2.88E–10	2.04E–05	5.87E–15	2.93E–11	2.89E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	2.21E–06	^{14}C	2.20E–09	2.04E–05	4.49E–14	2.24E–10	2.21E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	2.39E–14	^{109}Cd	2.38E–17	2.04E–05	4.85E–22	2.42E–18	2.39E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	5.80E–02	^{113m}Cd	5.78E–05	2.04E–05	1.18E–09	5.88E–06	5.80E–02	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	7.34E–07	^{142}Ce	7.31E–10	2.04E–05	1.49E–14	7.44E–11	7.34E–07	0.00%

Table A-9. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{144}Ce	2.33E–10	1.8	4.19E–10	2.34E–07	^{144}Ce	2.33E–10	2.04E–05	4.75E–15	2.37E–11	2.34E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	7.23E–13	^{249}Cf	7.21E–16	2.04E–05	1.47E–20	7.33E–17	7.23E–13	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	3.74E–13	^{250}Cf	3.73E–16	2.04E–05	7.61E–21	3.80E–17	3.74E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	1.15E–14	^{251}Cf	1.14E–17	2.04E–05	2.33E–22	1.16E–18	1.15E–14	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	4.86E–16	^{252}Cf	4.84E–19	2.04E–05	9.88E–24	4.93E–20	4.86E–16	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	5.93E–04	^{242}Cm	5.91E–07	2.04E–05	1.21E–11	6.02E–08	5.94E–04	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	1.29E–04	^{243}Cm	1.29E–07	2.04E–05	2.62E–12	1.31E–08	1.29E–04	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	7.06E–03	^{244}Cm	7.03E–06	2.04E–05	1.43E–10	7.16E–07	7.06E–03	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	1.69E–06	^{245}Cm	1.68E–09	2.04E–05	3.43E–14	1.71E–10	1.69E–06	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	1.11E–07	^{246}Cm	1.10E–10	2.04E–05	2.25E–15	1.12E–11	1.11E–07	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	1.22E–13	^{247}Cm	1.22E–16	2.04E–05	2.49E–21	1.24E–17	1.22E–13	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	1.29E–13	^{248}Cm	1.29E–16	2.04E–05	2.63E–21	1.31E–17	1.29E–13	0.00%
^{60}Co	[d]		5.02E–05	2.80E–02	^{60}Co	[d]		3.53E–09	1.76E–05	2.80E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	3.04E–02	^{134}Cs	3.03E–05	2.04E–05	6.19E–10	3.09E–06	3.04E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	1.44E–02	^{135}Cs	1.44E–05	2.04E–05	2.93E–10	1.46E–06	1.44E–02	0.00%
^{137}Cs	[d]		9.20E–01	5.13E+02	^{137}Cs	[e]		2.04E–05	1.02E–01	5.13E+02	47.63%
^{150}Eu	2.96E–10	1.8	5.34E–10	2.98E–07	^{150}Eu	2.96E–10	2.04E–05	6.05E–15	3.02E–11	2.98E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	3.93E–02	^{152}Eu	3.92E–05	2.04E–05	7.99E–10	3.99E–06	3.93E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	1.75E+00	^{154}Eu	[e]		1.60E–08	7.98E–05	1.75E+00	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	4.75E–01	^{155}Eu	[e]		1.45E–09	7.23E–06	4.75E–01	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	4.90E–01	^{55}Fe	4.88E–04	2.04E–05	9.96E–09	4.97E–05	4.90E–01	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	5.63E–09	^{221}Fr	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	1.66E–08	^{223}Fr	1.65E–11	2.04E–05	3.37E–16	1.68E–12	1.66E–08	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	3.59E–14	^{152}Gd	3.58E–17	2.04E–05	7.30E–22	3.64E–18	3.59E–14	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	4.17E–16	^{153}Gd	4.15E–19	2.04E–05	8.47E–24	4.23E–20	4.17E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	3.23E–01	^{3}H	[e]		3.20E–09	1.60E–05	3.23E–01	0.03%

Table A-9. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{166m}Ho	1.13E–09	1.8	2.03E–09	1.13E–06	^{166m}Ho	1.13E–09	2.04E–05	2.30E–14	1.15E–10	1.13E–06	0.00%
^{129}I	[d]		6.24E–07	3.48E–04	^{129}I	[e]		8.14E–11	4.06E–07	3.48E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	2.76E–13	^{115}In	2.75E–16	2.04E–05	5.61E–21	2.80E–17	2.76E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	4.70E–12	^{138}La	4.68E–15	2.04E–05	9.56E–20	4.77E–16	4.70E–12	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	8.77E–02	^{93m}Nb	8.74E–05	2.04E–05	1.78E–09	8.89E–06	8.77E–02	0.01%
^{94}Nb	[d]		1.66E–04	9.26E–02	^{94}Nb	[e]		2.35E–08	1.17E–04	9.27E–02	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	3.98E–11	^{144}Nd	3.96E–14	2.04E–05	8.09E–19	4.03E–15	3.98E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	1.13E–02	^{59}Ni	1.13E–05	2.04E–05	2.30E–10	1.15E–06	1.13E–02	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	1.29E+00	^{63}Ni	[e]		2.67E–09	1.33E–05	1.29E+00	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	2.21E–07	^{236}Np	2.21E–10	2.04E–05	4.50E–15	2.24E–11	2.21E–07	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	2.12E–02	^{237}Np	[e]		1.74E–09	8.68E–06	2.12E–02	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	3.60E–06	^{238}Np	3.58E–09	2.04E–05	7.31E–14	3.65E–10	3.60E–06	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	9.87E–04	^{239}Np	9.83E–07	2.04E–05	2.01E–11	1.00E–07	9.87E–04	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	2.95E–11	^{240m}Np	2.94E–14	2.04E–05	5.99E–19	2.99E–15	2.95E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	2.13E–06	^{231}Pa	2.12E–09	2.04E–05	4.33E–14	2.16E–10	2.13E–06	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	2.12E–02	^{233}Pa	2.11E–05	2.04E–05	4.30E–10	2.15E–06	2.12E–02	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	1.07E–06	^{234}Pa	1.06E–09	2.04E–05	2.17E–14	1.08E–10	1.07E–06	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	8.20E–04	^{234m}Pa	8.17E–07	2.04E–05	1.67E–11	8.31E–08	8.20E–04	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	5.63E–09	^{209}Pb	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	1.12E–07	^{210}Pb	1.11E–10	2.04E–05	2.27E–15	1.13E–11	1.12E–07	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	1.20E–06	^{211}Pb	1.20E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	7.21E–05	^{212}Pb	7.18E–08	2.04E–05	1.47E–12	7.31E–09	7.21E–05	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	2.89E–07	^{214}Pb	2.88E–10	2.04E–05	5.87E–15	2.93E–11	2.89E–07	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	4.07E–04	^{107}Pd	4.06E–07	2.04E–05	8.28E–12	4.13E–08	4.07E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	4.01E–04	^{146}Pm	4.00E–07	2.04E–05	8.16E–12	4.07E–08	4.01E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	3.90E–01	^{147}Pm	3.88E–04	2.04E–05	7.92E–09	3.95E–05	3.90E–01	0.04%

Table A-9. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{210}Po	1.08E–10	1.8	1.94E–10	1.08E–07	^{210}Po	1.08E–10	2.04E–05	2.20E–15	1.10E–11	1.08E–07	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	3.37E–09	^{211}Po	3.35E–12	2.04E–05	6.84E–17	3.41E–13	3.37E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	4.62E–05	^{212}Po	4.60E–08	2.04E–05	9.39E–13	4.68E–09	4.62E–05	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	5.51E–09	^{213}Po	5.49E–12	2.04E–05	1.12E–16	5.59E–13	5.51E–09	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	2.89E–07	^{214}Po	2.87E–10	2.04E–05	5.86E–15	2.93E–11	2.89E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	1.20E–06	^{215}Po	1.20E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	7.21E–05	^{216}Po	7.18E–08	2.04E–05	1.47E–12	7.31E–09	7.21E–05	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	2.89E–07	^{218}Po	2.88E–10	2.04E–05	5.87E–15	2.93E–11	2.89E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	2.34E–07	^{144}Pr	2.33E–10	2.04E–05	4.75E–15	2.37E–11	2.34E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	2.80E–09	^{144m}Pr	2.79E–12	2.04E–05	5.70E–17	2.84E–13	2.80E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	6.55E–06	^{236}Pu	6.52E–09	2.04E–05	1.33E–13	6.64E–10	6.55E–06	0.00%
^{238}Pu	[d]		9.23E–03	5.15E+00	^{238}Pu	[e]		2.78E–06	1.39E–02	5.16E+00	0.48%
^{239}Pu	[d]		2.75E–03	1.53E+00	^{239}Pu	[e]		6.06E–07	3.02E–03	1.54E+00	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	6.08E–01	^{240}Pu	6.06E–04	2.04E–05	1.24E–08	6.17E–05	6.08E–01	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	8.78E+00	^{241}Pu	[e]		3.80E–06	1.90E–02	8.80E+00	0.82%
^{242}Pu	4.43E–07	1.8	7.98E–07	4.45E–04	^{242}Pu	4.43E–07	2.04E–05	9.04E–12	4.51E–08	4.45E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	1.22E–13	^{243}Pu	1.22E–16	2.04E–05	2.49E–21	1.24E–17	1.22E–13	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	2.95E–11	^{244}Pu	2.94E–14	2.04E–05	6.00E–19	2.99E–15	2.95E–11	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	1.20E–06	^{223}Ra	1.20E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	7.21E–05	^{224}Ra	7.18E–08	2.04E–05	1.47E–12	7.31E–09	7.21E–05	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	5.63E–09	^{225}Ra	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	2.89E–07	^{226}Ra	2.88E–10	2.04E–05	5.87E–15	2.93E–11	2.89E–07	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	1.73E–11	^{228}Ra	1.73E–14	2.04E–05	3.52E–19	1.76E–15	1.73E–11	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	7.17E–07	^{87}Rb	7.15E–10	2.04E–05	1.46E–14	7.27E–11	7.17E–07	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	2.47E–06	^{102}Rh	2.46E–09	2.04E–05	5.03E–14	2.51E–10	2.47E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	7.71E–06	^{106}Rh	7.69E–09	2.04E–05	1.57E–13	7.82E–10	7.71E–06	0.00%

Table A-9. (continued).

	Solids				Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{219}Rn	1.20E–09	1.8	2.16E–09	1.20E–06	^{219}Rn	1.20E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	7.21E–05	^{220}Rn	7.18E–08	2.04E–05	1.47E–12	7.31E–09	7.21E–05	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	2.89E–07	^{222}Rn	2.88E–10	2.04E–05	5.87E–15	2.93E–11	2.89E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	7.71E–06	^{106}Ru	7.69E–09	2.04E–05	1.57E–13	7.82E–10	7.71E–06	0.00%
^{125}Sb	[d]		5.55E–04	3.09E–01	^{125}Sb	[e]		1.55E–08	7.73E–05	3.10E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	1.42E–03	^{126}Sb	1.41E–06	2.04E–05	2.89E–11	1.44E–07	1.42E–03	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	1.01E–02	^{126m}Sb	1.01E–05	2.04E–05	2.06E–10	1.03E–06	1.01E–02	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	1.08E–02	^{79}Se	1.07E–05	2.04E–05	2.19E–10	1.09E–06	1.08E–02	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	4.66E–09	^{146}Sm	4.65E–12	2.04E–05	9.48E–17	4.73E–13	4.66E–09	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	1.82E–07	^{147}Sm	1.81E–10	2.04E–05	3.70E–15	1.85E–11	1.82E–07	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	9.34E–13	^{148}Sm	9.30E–16	2.04E–05	1.90E–20	9.47E–17	9.34E–13	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	8.29E–14	^{149}Sm	8.26E–17	2.04E–05	1.68E–21	8.41E–18	8.29E–14	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	7.74E+00	^{151}Sm	7.71E–03	2.04E–05	1.57E–07	7.84E–04	7.74E+00	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	9.58E–12	^{119m}Sn	9.55E–15	2.04E–05	1.95E–19	9.72E–16	9.58E–12	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	5.76E–02	^{121m}Sn	5.74E–05	2.04E–05	1.17E–09	5.84E–06	5.76E–02	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	1.01E–02	^{126}Sn	1.01E–05	2.04E–05	2.06E–10	1.03E–06	1.01E–02	0.00%
^{90}Sr	[d]		1.87E–02	1.04E+01	^{90}Sr	[e]		2.55E–06	1.27E–02	1.04E+01	0.97%
^{98}Tc	6.34E–11	1.8	1.14E–10	6.37E–08	^{98}Tc	6.34E–11	2.04E–05	1.29E–15	6.46E–12	6.37E–08	0.00%
^{99}Tc	[d]		6.17E–04	3.44E–01	^{99}Tc	[e]		1.03E–09	5.14E–06	3.44E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	5.14E–14	^{123}Te	5.12E–17	2.04E–05	1.05E–21	5.21E–18	5.14E–14	0.00%
^{125m}Te	1.43E–05		1.36E–04	7.58E–02	^{125m}Te	1.43E–05	2.04E–05	2.92E–10	1.46E–06	7.58E–02	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	1.19E–06	^{227}Th	1.18E–09	2.04E–05	2.41E–14	1.20E–10	1.19E–06	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	7.19E–05	^{228}Th	7.16E–08	2.04E–05	1.46E–12	7.29E–09	7.19E–05	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	5.63E–09	^{229}Th	5.61E–12	2.04E–05	1.14E–16	5.71E–13	5.63E–09	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	2.36E–05	^{230}Th	2.35E–08	2.04E–05	4.80E–13	2.40E–09	2.36E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	7.96E–04	^{231}Th	7.93E–07	2.04E–05	1.62E–11	8.07E–08	7.96E–04	0.00%

Table A-9. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{232}Th	1.85E–14	1.8	3.33E–14	1.86E–11	^{232}Th	1.85E–14	2.04E–05	3.77E–19	1.88E–15	1.86E–11	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	8.20E–04	^{234}Th	8.17E–07	2.04E–05	1.67E–11	8.31E–08	8.20E–04	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	1.20E–06	^{207}Tl	1.19E–09	2.04E–05	2.44E–14	1.22E–10	1.20E–06	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	2.59E–05	^{208}Tl	2.58E–08	2.04E–05	5.27E–13	2.63E–09	2.59E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	1.22E–10	^{209}Tl	1.21E–13	2.04E–05	2.47E–18	1.23E–14	1.22E–10	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	4.81E–13	^{171}Tm	4.80E–16	2.04E–05	9.78E–21	4.88E–17	4.81E–13	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	6.94E–05	^{232}U	6.91E–08	2.04E–05	1.41E–12	7.03E–09	6.94E–05	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	1.78E–06	^{233}U	1.77E–09	2.04E–05	3.62E–14	1.81E–10	1.78E–06	0.00%
^{234}U	[d]		2.98E–06	1.66E–03	^{234}U	[e]		3.34E–10	1.67E–06	1.66E–03	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	7.96E–04	^{235}U	7.93E–07	2.04E–05	1.62E–11	8.07E–08	7.96E–04	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	1.86E–03	^{236}U	1.85E–06	2.04E–05	3.77E–11	1.88E–07	1.86E–03	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	2.15E–04	^{237}U	2.15E–07	2.04E–05	4.38E–12	2.18E–08	2.15E–04	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	8.20E–04	^{238}U	8.17E–07	2.04E–05	1.67E–11	8.31E–08	8.20E–04	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	2.95E–11	^{240}U	2.94E–14	2.04E–05	5.99E–19	2.99E–15	2.95E–11	0.00%
^{90}Y	[d]		1.87E–02	1.04E+01	^{90}Y	8.88E–01	2.04E–05	1.81E–05	9.04E–02	1.05E+01	0.97%
^{93}Zr	1.06E–04	1.8	1.90E–04	1.06E–01	^{93}Zr	1.06E–04	2.04E–05	2.16E–09	1.08E–05	1.06E–01	0.01%
			Total	1,077				Total	0.27	1,077	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-184.

Table A-10. Post-decontamination estimated inventory for Tank WM-185.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	7.27E–09	^{225}Ac	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	1.55E–06	^{227}Ac	1.20E–09	2.11E–05	2.52E–14	1.26E–10	1.55E–06	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	2.24E–11	^{228}Ac	1.73E–14	2.11E–05	3.64E–19	1.82E–15	2.24E–11	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	3.69E–10	^{108}Ag	2.85E–13	2.11E–05	6.01E–18	3.00E–14	3.69E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	4.15E–09	^{108m}Ag	3.20E–12	2.11E–05	6.76E–17	3.37E–13	4.15E–09	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	3.08E–14	^{109m}Ag	2.38E–17	2.11E–05	5.02E–22	2.50E–18	3.08E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	1.16E–15	^{110}Ag	8.93E–19	2.11E–05	1.88E–23	9.40E–20	1.16E–15	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	8.70E–14	^{110m}Ag	6.71E–17	2.11E–05	1.42E–21	7.07E–18	8.70E–14	0.00%
^{241}Am	[d]		3.40E–04	2.45E–01	^{241}Am	[e]		2.28E–09	1.14E–05	2.45E–01	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	9.25E–04	^{242}Am	7.13E–07	2.11E–05	1.51E–11	7.51E–08	9.25E–04	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	9.29E–04	^{242m}Am	7.17E–07	2.11E–05	1.51E–11	7.55E–08	9.29E–04	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	1.27E–03	^{243}Am	9.83E–07	2.11E–05	2.07E–11	1.03E–07	1.27E–03	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	7.27E–09	^{217}At	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{137m}Ba	[d]		9.20E–01	6.62E+02	^{137m}Ba	[e]		2.11E–05	1.05E–01	6.63E+02	47.64%
^{10}Be	7.56E–11	1.8	1.36E–10	9.80E–08	^{10}Be	7.56E–11	2.11E–05	1.60E–15	7.96E–12	9.80E–08	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	1.44E–07	^{210}Bi	1.11E–10	2.11E–05	2.35E–15	1.17E–11	1.44E–07	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	7.02E–21	^{210m}Bi	5.41E–24	2.11E–05	1.14E–28	5.70E–25	7.02E–21	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	1.55E–06	^{211}Bi	1.20E–09	2.11E–05	2.53E–14	1.26E–10	1.55E–06	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	9.31E–05	^{212}Bi	7.18E–08	2.11E–05	1.52E–12	7.56E–09	9.31E–05	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	7.27E–09	^{213}Bi	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	3.73E–07	^{214}Bi	2.88E–10	2.11E–05	6.07E–15	3.03E–11	3.73E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	2.85E–06	^{14}C	2.20E–09	2.11E–05	4.64E–14	2.32E–10	2.85E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	3.08E–14	^{109}Cd	2.38E–17	2.11E–05	5.02E–22	2.50E–18	3.08E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	7.49E–02	^{113m}Cd	5.78E–05	2.11E–05	1.22E–09	6.08E–06	7.49E–02	0.01%
^{142}Ce	7.31E–10	1.8	1.32E–09	9.48E–07	^{142}Ce	7.31E–10	2.11E–05	1.54E–14	7.70E–11	9.48E–07	0.00%

Table A-10. (continued).

Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{144}Ce	2.33E–10	1.8	4.19E–10	3.02E–07	^{144}Ce	2.33E–10	2.11E–05	4.91E–15	2.45E–11	3.02E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	9.34E–13	^{249}Cf	7.21E–16	2.11E–05	1.52E–20	7.58E–17	9.34E–13	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	4.83E–13	^{250}Cf	3.73E–16	2.11E–05	7.87E–21	3.93E–17	4.83E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	1.48E–14	^{251}Cf	1.14E–17	2.11E–05	2.41E–22	1.20E–18	1.48E–14	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	6.28E–16	^{252}Cf	4.84E–19	2.11E–05	1.02E–23	5.10E–20	6.28E–16	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	7.66E–04	^{242}Cm	5.91E–07	2.11E–05	1.25E–11	6.22E–08	7.66E–04	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	1.67E–04	^{243}Cm	1.29E–07	2.11E–05	2.71E–12	1.35E–08	1.67E–04	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	9.11E–03	^{244}Cm	7.03E–06	2.11E–05	1.48E–10	7.40E–07	9.12E–03	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	2.18E–06	^{245}Cm	1.68E–09	2.11E–05	3.55E–14	1.77E–10	2.18E–06	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	1.43E–07	^{246}Cm	1.10E–10	2.11E–05	2.32E–15	1.16E–11	1.43E–07	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	1.58E–13	^{247}Cm	1.22E–16	2.11E–05	2.57E–21	1.28E–17	1.58E–13	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	1.67E–13	^{248}Cm	1.29E–16	2.11E–05	2.72E–21	1.36E–17	1.67E–13	0.00%
^{60}Co	[d]		5.02E–05	3.61E–02	^{60}Co	3.70E–04	2.11E–05	7.82E–09	3.90E–05	3.62E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	3.93E–02	^{134}Cs	3.03E–05	2.11E–05	6.40E–10	3.19E–06	3.93E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	1.86E–02	^{135}Cs	1.44E–05	2.11E–05	3.03E–10	1.51E–06	1.86E–02	0.00%
^{137}Cs	[d]		9.20E–01	6.62E+02	^{137}Cs	[e]		2.11E–05	1.05E–01	6.63E+02	47.64%
^{150}Eu	2.96E–10	1.8	5.34E–10	3.84E–07	^{150}Eu	2.96E–10	2.11E–05	6.26E–15	3.12E–11	3.84E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	5.08E–02	^{152}Eu	3.92E–05	2.11E–05	8.27E–10	4.12E–06	5.08E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	2.26E+00	^{154}Eu	[e]		1.94E–08	9.68E–05	2.26E+00	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	6.14E–01	^{155}Eu	4.74E–04	2.11E–05	9.99E–09	4.99E–05	6.14E–01	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	6.33E–01	^{55}Fe	4.88E–04	2.11E–05	1.03E–08	5.14E–05	6.33E–01	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	7.27E–09	^{221}Fr	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	2.14E–08	^{223}Fr	1.65E–11	2.11E–05	3.48E–16	1.74E–12	2.14E–08	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	4.64E–14	^{152}Gd	3.58E–17	2.11E–05	7.55E–22	3.77E–18	4.64E–14	0.00%
^{153}Gd	4.15E–19	1.8	7.48E–19	5.38E–16	^{153}Gd	4.15E–19	2.11E–05	8.76E–24	4.37E–20	5.38E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	4.17E–01	^{3}H	[e]		4.01E–09	2.00E–05	4.17E–01	0.03%

Table A-10. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{166m}Ho	1.13E–09	1.8	2.03E–09	1.46E–06	^{166m}Ho	1.13E–09	2.11E–05	2.38E–14	1.19E–10	1.46E–06	0.00%
^{129}I	[d]		6.24E–07	4.49E–04	^{129}I	[e]		1.94E–10	9.68E–07	4.50E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	3.56E–13	^{115}In	2.75E–16	2.11E–05	5.80E–21	2.90E–17	3.56E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	6.07E–12	^{138}La	4.68E–15	2.11E–05	9.88E–20	4.93E–16	6.07E–12	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	1.13E–01	^{93m}Nb	8.74E–05	2.11E–05	1.84E–09	9.20E–06	1.13E–01	0.01%
^{94}Nb	[d]		1.66E–04	1.20E–01	^{94}Nb	3.62E–05	2.11E–05	7.64E–10	3.81E–06	1.20E–01	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	5.14E–11	^{144}Nd	3.96E–14	2.11E–05	8.36E–19	4.17E–15	5.14E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	1.46E–02	^{59}Ni	1.13E–05	2.11E–05	2.38E–10	1.19E–06	1.46E–02	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	1.66E+00	^{63}Ni	[e]		7.15E–09	3.57E–05	1.66E+00	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	2.86E–07	^{236}Np	2.21E–10	2.11E–05	4.65E–15	2.32E–11	2.86E–07	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	2.73E–02	^{237}Np	[e]		9.61E–11	4.79E–07	2.73E–02	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	4.65E–06	^{238}Np	3.58E–09	2.11E–05	7.56E–14	3.77E–10	4.65E–06	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	1.27E–03	^{239}Np	9.83E–07	2.11E–05	2.07E–11	1.03E–07	1.27E–03	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	3.81E–11	^{240m}Np	2.94E–14	2.11E–05	6.20E–19	3.09E–15	3.81E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	2.75E–06	^{231}Pa	2.12E–09	2.11E–05	4.47E–14	2.23E–10	2.75E–06	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	2.73E–02	^{233}Pa	2.11E–05	2.11E–05	4.45E–10	2.22E–06	2.74E–02	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	1.38E–06	^{234}Pa	1.06E–09	2.11E–05	2.24E–14	1.12E–10	1.38E–06	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	1.06E–03	^{234m}Pa	8.17E–07	2.11E–05	1.72E–11	8.60E–08	1.06E–03	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	7.27E–09	^{209}Pb	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	1.44E–07	^{210}Pb	1.11E–10	2.11E–05	2.35E–15	1.17E–11	1.44E–07	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	1.55E–06	^{211}Pb	1.20E–09	2.11E–05	2.53E–14	1.26E–10	1.55E–06	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	9.31E–05	^{212}Pb	7.18E–08	2.11E–05	1.52E–12	7.56E–09	9.31E–05	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	3.73E–07	^{214}Pb	2.88E–10	2.11E–05	6.07E–15	3.03E–11	3.73E–07	0.00%
^{107}Pd	4.06E–07	1.8	7.31E–07	5.26E–04	^{107}Pd	4.06E–07	2.11E–05	8.56E–12	4.27E–08	5.26E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	5.18E–04	^{146}Pm	4.00E–07	2.11E–05	8.44E–12	4.21E–08	5.18E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	5.03E–01	^{147}Pm	3.88E–04	2.11E–05	8.19E–09	4.09E–05	5.03E–01	0.04%

Table A-10. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{210}Po	1.08E–10	1.8	1.94E–10	1.39E–07	^{210}Po	1.08E–10	2.11E–05	2.27E–15	1.13E–11	1.39E–07	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	4.35E–09	^{211}Po	3.35E–12	2.11E–05	7.08E–17	3.53E–13	4.35E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	5.97E–05	^{212}Po	4.60E–08	2.11E–05	9.71E–13	4.85E–09	5.97E–05	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	7.11E–09	^{213}Po	5.49E–12	2.11E–05	1.16E–16	5.78E–13	7.11E–09	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	3.73E–07	^{214}Po	2.87E–10	2.11E–05	6.07E–15	3.03E–11	3.73E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	1.55E–06	^{215}Po	1.20E–09	2.11E–05	2.53E–14	1.26E–10	1.55E–06	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	9.31E–05	^{216}Po	7.18E–08	2.11E–05	1.52E–12	7.56E–09	9.31E–05	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	3.73E–07	^{218}Po	2.88E–10	2.11E–05	6.07E–15	3.03E–11	3.73E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	3.02E–07	^{144}Pr	2.33E–10	2.11E–05	4.91E–15	2.45E–11	3.02E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	3.62E–09	^{144m}Pr	2.79E–12	2.11E–05	5.89E–17	2.94E–13	3.62E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	8.45E–06	^{236}Pu	6.52E–09	2.11E–05	1.38E–13	6.87E–10	8.46E–06	0.00%
^{238}Pu	[d]		9.23E–03	6.65E+00	^{238}Pu	[e]		8.59E–08	4.29E–04	6.65E+00	0.48%
^{239}Pu	[d]		2.75E–03	1.98E+00	^{239}Pu	[e]		6.82E–09	3.40E–05	1.98E+00	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	7.85E–01	^{240}Pu	6.06E–04	2.11E–05	1.28E–08	6.38E–05	7.85E–01	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	1.13E+01	^{241}Pu	[e]		8.95E–08	4.47E–04	1.13E+01	0.82%
^{242}Pu	4.43E–07	1.8	7.98E–07	5.74E–04	^{242}Pu	4.43E–07	2.11E–05	9.35E–12	4.66E–08	5.74E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	1.58E–13	^{243}Pu	1.22E–16	2.11E–05	2.57E–21	1.28E–17	1.58E–13	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	3.81E–11	^{244}Pu	2.94E–14	2.11E–05	6.20E–19	3.09E–15	3.81E–11	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	1.55E–06	^{223}Ra	1.20E–09	2.11E–05	2.53E–14	1.26E–10	1.55E–06	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	9.31E–05	^{224}Ra	7.18E–08	2.11E–05	1.52E–12	7.56E–09	9.31E–05	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	7.27E–09	^{225}Ra	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	3.73E–07	^{226}Ra	2.88E–10	2.11E–05	6.07E–15	3.03E–11	3.73E–07	0.00%
^{228}Ra	1.73E–14	1.8	3.11E–14	2.24E–11	^{228}Ra	1.73E–14	2.11E–05	3.64E–19	1.82E–15	2.24E–11	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	9.26E–07	^{87}Rb	7.15E–10	2.11E–05	1.51E–14	7.52E–11	9.26E–07	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	3.19E–06	^{102}Rh	2.46E–09	2.11E–05	5.20E–14	2.59E–10	3.19E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	9.96E–06	^{106}Rh	7.69E–09	2.11E–05	1.62E–13	8.09E–10	9.96E–06	0.00%

Table A-10. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{219}Rn	1.20E–09	1.8	2.16E–09	1.55E–06	^{219}Rn	1.20E–09	2.11E–05	2.53E–14	1.26E–10	1.55E–06	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	9.31E–05	^{220}Rn	7.18E–08	2.11E–05	1.52E–12	7.56E–09	9.31E–05	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	3.73E–07	^{222}Rn	2.88E–10	2.11E–05	6.07E–15	3.03E–11	3.73E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	9.96E–06	^{106}Ru	7.69E–09	2.11E–05	1.62E–13	8.09E–10	9.96E–06	0.00%
^{125}Sb	[d]		5.55E–04	4.00E–01	^{125}Sb	5.87E–05	2.11E–05	1.24E–09	6.18E–06	4.00E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	1.83E–03	^{126}Sb	1.41E–06	2.11E–05	2.98E–11	1.49E–07	1.83E–03	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	1.31E–02	^{126m}Sb	1.01E–05	2.11E–05	2.13E–10	1.06E–06	1.31E–02	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	1.39E–02	^{79}Se	1.07E–05	2.11E–05	2.26E–10	1.13E–06	1.39E–02	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	6.02E–09	^{146}Sm	4.65E–12	2.11E–05	9.80E–17	4.89E–13	6.02E–09	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	2.35E–07	^{147}Sm	1.81E–10	2.11E–05	3.83E–15	1.91E–11	2.35E–07	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	1.21E–12	^{148}Sm	9.30E–16	2.11E–05	1.96E–20	9.79E–17	1.21E–12	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	1.07E–13	^{149}Sm	8.26E–17	2.11E–05	1.74E–21	8.69E–18	1.07E–13	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	9.99E+00	^{151}Sm	7.71E–03	2.11E–05	1.63E–07	8.11E–04	9.99E+00	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	1.24E–11	^{119m}Sn	9.55E–15	2.11E–05	2.01E–19	1.00E–15	1.24E–11	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	7.44E–02	^{121m}Sn	5.74E–05	2.11E–05	1.21E–09	6.04E–06	7.44E–02	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	1.31E–02	^{126}Sn	1.01E–05	2.11E–05	2.13E–10	1.06E–06	1.31E–02	0.00%
^{90}Sr	[d]		1.87E–02	1.35E+01	^{90}Sr	[e]		1.98E–06	9.88E–03	1.35E+01	0.97%
^{98}Tc	6.34E–11	1.8	1.14E–10	8.22E–08	^{98}Tc	6.34E–11	2.11E–05	1.34E–15	6.68E–12	8.22E–08	0.00%
^{99}Tc	[d]		6.17E–04	4.44E–01	^{99}Tc	[e]		3.69E–10	1.84E–06	4.44E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	6.64E–14	^{123}Te	5.12E–17	2.11E–05	1.08E–21	5.39E–18	6.64E–14	0.00%
^{125m}Te	1.43E–05		1.36E–04	9.79E–02	^{125m}Te	1.43E–05	2.11E–05	3.02E–10	1.51E–06	9.79E–02	0.01%
^{227}Th	1.18E–09	1.8	2.13E–09	1.53E–06	^{227}Th	1.18E–09	2.11E–05	2.49E–14	1.24E–10	1.53E–06	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	9.28E–05	^{228}Th	7.16E–08	2.11E–05	1.51E–12	7.54E–09	9.28E–05	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	7.27E–09	^{229}Th	5.61E–12	2.11E–05	1.18E–16	5.90E–13	7.27E–09	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	3.05E–05	^{230}Th	2.35E–08	2.11E–05	4.97E–13	2.48E–09	3.05E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	1.03E–03	^{231}Th	7.93E–07	2.11E–05	1.67E–11	8.35E–08	1.03E–03	0.00%

Table A-10. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{232}Th	1.85E–14	1.8	3.33E–14	2.40E–11	^{232}Th	1.85E–14	2.11E–05	3.90E–19	1.95E–15	2.40E–11	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	1.06E–03	^{234}Th	8.17E–07	2.11E–05	1.72E–11	8.60E–08	1.06E–03	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	1.55E–06	^{207}Tl	1.19E–09	2.11E–05	2.52E–14	1.26E–10	1.55E–06	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	3.35E–05	^{208}Tl	2.58E–08	2.11E–05	5.45E–13	2.72E–09	3.35E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	1.57E–10	^{209}Tl	1.21E–13	2.11E–05	2.56E–18	1.28E–14	1.57E–10	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	6.22E–13	^{171}Tm	4.80E–16	2.11E–05	1.01E–20	5.05E–17	6.22E–13	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	8.96E–05	^{232}U	6.91E–08	2.11E–05	1.46E–12	7.27E–09	8.96E–05	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	2.30E–06	^{233}U	1.77E–09	2.11E–05	3.74E–14	1.87E–10	2.30E–06	0.00%
^{234}U	[d]		2.98E–06	2.15E–03	^{234}U	3.37E–05	2.11E–05	7.11E–10	3.55E–06	2.15E–03	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	1.03E–03	^{235}U	7.93E–07	2.11E–05	1.67E–11	8.35E–08	1.03E–03	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	2.40E–03	^{236}U	1.85E–06	2.11E–05	3.90E–11	1.95E–07	2.40E–03	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	2.78E–04	^{237}U	2.15E–07	2.11E–05	4.53E–12	2.26E–08	2.78E–04	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	1.06E–03	^{238}U	8.17E–07	2.11E–05	1.72E–11	8.60E–08	1.06E–03	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	3.81E–11	^{240}U	2.94E–14	2.11E–05	6.20E–19	3.09E–15	3.81E–11	0.00%
^{90}Y	[d]		1.87E–02	1.35E+01	^{90}Y	8.88E–01	2.11E–05	1.87E–05	9.35E–02	1.36E+01	0.97%
^{93}Zr	1.06E–04	1.8	1.90E–04	1.37E–01	^{93}Zr	1.06E–04	2.11E–05	2.23E–09	1.11E–05	1.37E–01	0.01%
			Total	1,391				Total	0.23	1,391	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-185.

Table A-11. Post-decontamination estimated inventory for Tank WM-186.

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{225}Ac	5.61E–12	1.8	1.01E–11	3.37E–09	^{225}Ac	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{227}Ac	1.20E–09	1.8	2.15E–09	7.19E–07	^{227}Ac	1.20E–09	2.88E–06	3.44E–15	1.72E–11	7.19E–07	0.00%
^{228}Ac	1.73E–14	1.8	3.11E–14	1.04E–11	^{228}Ac	1.73E–14	2.88E–06	4.97E–20	2.48E–16	1.04E–11	0.00%
^{108}Ag	2.85E–13	1.8	5.13E–13	1.71E–10	^{108}Ag	2.85E–13	2.88E–06	8.21E–19	4.09E–15	1.71E–10	0.00%
^{108m}Ag	3.20E–12	1.8	5.76E–12	1.93E–09	^{108m}Ag	3.20E–12	2.88E–06	9.22E–18	4.60E–14	1.93E–09	0.00%
^{109m}Ag	2.38E–17	1.8	4.28E–17	1.43E–14	^{109m}Ag	2.38E–17	2.88E–06	6.85E–23	3.42E–19	1.43E–14	0.00%
^{110}Ag	8.93E–19	1.8	1.61E–18	5.37E–16	^{110}Ag	8.93E–19	2.88E–06	2.57E–24	1.28E–20	5.37E–16	0.00%
^{110m}Ag	6.71E–17	1.8	1.21E–16	4.04E–14	^{110m}Ag	6.71E–17	2.88E–06	1.93E–22	9.65E–19	4.04E–14	0.00%
^{241}Am	[d]		3.40E–04	1.14E–01	^{241}Am	[e]		1.14E–09	5.69E–06	1.14E–01	0.02%
^{242}Am	7.13E–07	1.8	1.28E–06	4.29E–04	^{242}Am	7.13E–07	2.88E–06	2.05E–12	1.03E–08	4.29E–04	0.00%
^{242m}Am	7.17E–07	1.8	1.29E–06	4.32E–04	^{242m}Am	7.17E–07	2.88E–06	2.06E–12	1.03E–08	4.32E–04	0.00%
^{243}Am	9.83E–07	1.8	1.77E–06	5.92E–04	^{243}Am	9.83E–07	2.88E–06	2.83E–12	1.41E–08	5.92E–04	0.00%
^{217}At	5.61E–12	1.8	1.01E–11	3.37E–09	^{217}At	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{137m}Ba	[b]		9.20E–01	3.08E+02	^{137m}Ba	[e]		2.88E–06	1.44E–02	3.08E+02	47.63%
^{10}Be	7.56E–11	1.8	1.36E–10	4.55E–08	^{10}Be	7.56E–11	2.88E–06	2.18E–16	1.09E–12	4.55E–08	0.00%
^{210}Bi	1.11E–10	1.8	2.01E–10	6.71E–08	^{210}Bi	1.11E–10	2.88E–06	3.21E–16	1.60E–12	6.71E–08	0.00%
^{210m}Bi	5.41E–24	1.8	9.75E–24	3.26E–21	^{210m}Bi	5.41E–24	2.88E–06	1.56E–29	7.78E–26	3.26E–21	0.00%
^{211}Bi	1.20E–09	1.8	2.16E–09	7.21E–07	^{211}Bi	1.20E–09	2.88E–06	3.45E–15	1.72E–11	7.21E–07	0.00%
^{212}Bi	7.18E–08	1.8	1.29E–07	4.32E–05	^{212}Bi	7.18E–08	2.88E–06	2.07E–13	1.03E–09	4.32E–05	0.00%
^{213}Bi	5.61E–12	1.8	1.01E–11	3.37E–09	^{213}Bi	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{214}Bi	2.88E–10	1.8	5.18E–10	1.73E–07	^{214}Bi	2.88E–10	2.88E–06	8.28E–16	4.13E–12	1.73E–07	0.00%
^{14}C	2.20E–09	1.8	3.96E–09	1.32E–06	^{14}C	2.20E–09	2.88E–06	6.34E–15	3.16E–11	1.32E–06	0.00%
^{109}Cd	2.38E–17	1.8	4.28E–17	1.43E–14	^{109}Cd	2.38E–17	2.88E–06	6.85E–23	3.42E–19	1.43E–14	0.00%
^{113m}Cd	5.78E–05	1.8	1.04E–04	3.48E–02	^{113m}Cd	5.78E–05	2.88E–06	1.66E–10	8.30E–07	3.48E–02	0.01%

Table A-11. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{142}Ce	7.31E–10	1.8	1.32E–09	4.40E–07	^{142}Ce	7.31E–10	2.88E–06	2.11E–15	1.05E–11	4.40E–07	0.00%
^{144}Ce	2.33E–10	1.8	4.19E–10	1.40E–07	^{144}Ce	2.33E–10	2.88E–06	6.70E–16	3.34E–12	1.40E–07	0.00%
^{249}Cf	7.21E–16	1.8	1.30E–15	4.34E–13	^{249}Cf	7.21E–16	2.88E–06	2.08E–21	1.04E–17	4.34E–13	0.00%
^{250}Cf	3.73E–16	1.8	6.71E–16	2.24E–13	^{250}Cf	3.73E–16	2.88E–06	1.07E–21	5.36E–18	2.24E–13	0.00%
^{251}Cf	1.14E–17	1.8	2.06E–17	6.88E–15	^{251}Cf	1.14E–17	2.88E–06	3.29E–23	1.64E–19	6.88E–15	0.00%
^{252}Cf	4.84E–19	1.8	8.72E–19	2.91E–16	^{252}Cf	4.84E–19	2.88E–06	1.39E–24	6.96E–21	2.91E–16	0.00%
^{242}Cm	5.91E–07	1.8	1.06E–06	3.56E–04	^{242}Cm	5.91E–07	2.88E–06	1.70E–12	8.50E–09	3.56E–04	0.00%
^{243}Cm	1.29E–07	1.8	2.31E–07	7.74E–05	^{243}Cm	1.29E–07	2.88E–06	3.70E–13	1.85E–09	7.74E–05	0.00%
^{244}Cm	7.03E–06	1.8	1.27E–05	4.23E–03	^{244}Cm	7.03E–06	2.88E–06	2.03E–11	1.01E–07	4.23E–03	0.00%
^{245}Cm	1.68E–09	1.8	3.02E–09	1.01E–06	^{245}Cm	1.68E–09	2.88E–06	4.84E–15	2.41E–11	1.01E–06	0.00%
^{246}Cm	1.10E–10	1.8	1.98E–10	6.63E–08	^{246}Cm	1.10E–10	2.88E–06	3.17E–16	1.58E–12	6.63E–08	0.00%
^{247}Cm	1.22E–16	1.8	2.20E–16	7.34E–14	^{247}Cm	1.22E–16	2.88E–06	3.51E–22	1.75E–18	7.34E–14	0.00%
^{248}Cm	1.29E–16	1.8	2.32E–16	7.75E–14	^{248}Cm	1.29E–16	2.88E–06	3.71E–22	1.85E–18	7.75E–14	0.00%
^{60}Co	[d]		5.02E–05	1.68E–02	^{60}Co	[e]		1.44E–09	7.18E–06	1.68E–02	0.00%
^{134}Cs	3.03E–05	1.8	5.46E–05	1.83E–02	^{134}Cs	3.03E–05	2.88E–06	8.74E–11	4.36E–07	1.83E–02	0.00%
^{135}Cs	1.44E–05	1.8	2.59E–05	8.66E–03	^{135}Cs	1.44E–05	2.88E–06	4.14E–11	2.07E–07	8.66E–03	0.00%
^{137}Cs	[d]		9.20E–01	3.08E+02	^{137}Cs	[e]		2.88E–06	1.44E–02	3.08E+02	47.63%
^{150}Eu	2.96E–10	1.8	5.34E–10	1.78E–07	^{150}Eu	2.96E–10	2.88E–06	8.54E–16	4.26E–12	1.78E–07	0.00%
^{152}Eu	3.92E–05	1.8	7.05E–05	2.36E–02	^{152}Eu	3.92E–05	2.88E–06	1.13E–10	5.63E–07	2.36E–02	0.00%
^{154}Eu	1.75E–03	1.8	3.15E–03	1.05E+00	^{154}Eu	[e]		6.02E–09	3.00E–05	1.05E+00	0.16%
^{155}Eu	4.74E–04	1.8	8.53E–04	2.85E–01	^{155}Eu	4.74E–04	2.88E–06	1.36E–09	6.81E–06	2.85E–01	0.04%
^{55}Fe	4.88E–04	1.8	8.79E–04	2.94E–01	^{55}Fe	4.88E–04	2.88E–06	1.41E–09	7.01E–06	2.94E–01	0.05%
^{221}Fr	5.61E–12	1.8	1.01E–11	3.37E–09	^{221}Fr	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{223}Fr	1.65E–11	1.8	2.97E–11	9.93E–09	^{223}Fr	1.65E–11	2.88E–06	4.75E–17	2.37E–13	9.93E–09	0.00%
^{152}Gd	3.58E–17	1.8	6.44E–17	2.15E–14	^{152}Gd	3.58E–17	2.88E–06	1.03E–22	5.14E–19	2.15E–14	0.00%

Table A-11. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{153}Gd	4.15E–19	1.8	7.48E–19	2.50E–16	^{153}Gd	4.15E–19	2.88E–06	1.20E–24	5.97E–21	2.50E–16	0.00%
^{3}H	3.22E–04	1.8	5.79E–04	1.94E–01	^{3}H	[e]		1.46E–09	7.28E–06	1.94E–01	0.03%
^{166m}Ho	1.13E–09	1.8	2.03E–09	6.78E–07	^{166m}Ho	1.13E–09	2.88E–06	3.24E–15	1.62E–11	6.78E–07	0.00%
^{129}I	[d]		6.24E–07	2.09E–04	^{129}I	[e]		2.89E–11	1.44E–07	2.09E–04	0.00%
^{115}In	2.75E–16	1.8	4.95E–16	1.66E–13	^{115}In	2.75E–16	2.88E–06	7.92E–22	3.95E–18	1.66E–13	0.00%
^{138}La	4.68E–15	1.8	8.43E–15	2.82E–12	^{138}La	4.68E–15	2.88E–06	1.35E–20	6.73E–17	2.82E–12	0.00%
^{93m}Nb	8.74E–05	1.8	1.57E–04	5.26E–02	^{93m}Nb	8.74E–05	2.88E–06	2.52E–10	1.26E–06	5.26E–02	0.01%
^{94}Nb	[d]		1.66E–04	5.55E–02	^{94}Nb	[e]		5.84E–09	2.91E–05	5.55E–02	0.01%
^{144}Nd	3.96E–14	1.8	7.14E–14	2.39E–11	^{144}Nd	3.96E–14	2.88E–06	1.14E–19	5.70E–16	2.39E–11	0.00%
^{59}Ni	1.13E–05	1.8	2.03E–05	6.78E–03	^{59}Ni	1.13E–05	2.88E–06	3.25E–11	1.62E–07	6.78E–03	0.00%
^{63}Ni	1.28E–03	1.8	2.31E–03	7.72E–01	^{63}Ni	[e]		5.78E–09	2.88E–05	7.72E–01	0.12%
^{236}Np	2.21E–10	1.8	3.97E–10	1.33E–07	^{236}Np	2.21E–10	2.88E–06	6.35E–16	3.17E–12	1.33E–07	0.00%
^{237}Np	2.11E–05	1.8	3.80E–05	1.27E–02	^{237}Np	[e]		6.67E–11	3.33E–07	1.27E–02	0.00%
^{238}Np	3.58E–09	1.8	6.45E–09	2.16E–06	^{238}Np	3.58E–09	2.88E–06	1.03E–14	5.15E–11	2.16E–06	0.00%
^{239}Np	9.83E–07	1.8	1.77E–06	5.92E–04	^{239}Np	9.83E–07	2.88E–06	2.83E–12	1.41E–08	5.92E–04	0.00%
^{240m}Np	2.94E–14	1.8	5.28E–14	1.77E–11	^{240m}Np	2.94E–14	2.88E–06	8.46E–20	4.22E–16	1.77E–11	0.00%
^{231}Pa	2.12E–09	1.8	3.82E–09	1.28E–06	^{231}Pa	2.12E–09	2.88E–06	6.11E–15	3.05E–11	1.28E–06	0.00%
^{233}Pa	2.11E–05	1.8	3.80E–05	1.27E–02	^{233}Pa	2.11E–05	2.88E–06	6.08E–11	3.03E–07	1.27E–02	0.00%
^{234}Pa	1.06E–09	1.8	1.91E–09	6.39E–07	^{234}Pa	1.06E–09	2.88E–06	3.06E–15	1.53E–11	6.39E–07	0.00%
^{234m}Pa	8.17E–07	1.8	1.47E–06	4.92E–04	^{234m}Pa	8.17E–07	2.88E–06	2.35E–12	1.17E–08	4.92E–04	0.00%
^{209}Pb	5.61E–12	1.8	1.01E–11	3.37E–09	^{209}Pb	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{210}Pb	1.11E–10	1.8	2.01E–10	6.71E–08	^{210}Pb	1.11E–10	2.88E–06	3.21E–16	1.60E–12	6.71E–08	0.00%
^{211}Pb	1.20E–09	1.8	2.16E–09	7.21E–07	^{211}Pb	1.20E–09	2.88E–06	3.45E–15	1.72E–11	7.21E–07	0.00%
^{212}Pb	7.18E–08	1.8	1.29E–07	4.32E–05	^{212}Pb	7.18E–08	2.88E–06	2.07E–13	1.03E–09	4.32E–05	0.00%
^{214}Pb	2.88E–10	1.8	5.18E–10	1.73E–07	^{214}Pb	2.88E–10	2.88E–06	8.28E–16	4.13E–12	1.73E–07	0.00%

Table A-11. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{107}Pd	4.06E–07	1.8	7.31E–07	2.44E–04	^{107}Pd	4.06E–07	2.88E–06	1.17E–12	5.83E–09	2.44E–04	0.00%
^{146}Pm	4.00E–07	1.8	7.20E–07	2.41E–04	^{146}Pm	4.00E–07	2.88E–06	1.15E–12	5.75E–09	2.41E–04	0.00%
^{147}Pm	3.88E–04	1.8	6.99E–04	2.34E–01	^{147}Pm	3.88E–04	2.88E–06	1.12E–09	5.58E–06	2.34E–01	0.04%
^{210}Po	1.08E–10	1.8	1.94E–10	6.48E–08	^{210}Po	1.08E–10	2.88E–06	3.10E–16	1.55E–12	6.48E–08	0.00%
^{211}Po	3.35E–12	1.8	6.04E–12	2.02E–09	^{211}Po	3.35E–12	2.88E–06	9.66E–18	4.82E–14	2.02E–09	0.00%
^{212}Po	4.60E–08	1.8	8.29E–08	2.77E–05	^{212}Po	4.60E–08	2.88E–06	1.33E–13	6.61E–10	2.77E–05	0.00%
^{213}Po	5.49E–12	1.8	9.88E–12	3.30E–09	^{213}Po	5.49E–12	2.88E–06	1.58E–17	7.89E–14	3.30E–09	0.00%
^{214}Po	2.87E–10	1.8	5.17E–10	1.73E–07	^{214}Po	2.87E–10	2.88E–06	8.28E–16	4.13E–12	1.73E–07	0.00%
^{215}Po	1.20E–09	1.8	2.16E–09	7.21E–07	^{215}Po	1.20E–09	2.88E–06	3.45E–15	1.72E–11	7.21E–07	0.00%
^{216}Po	7.18E–08	1.8	1.29E–07	4.32E–05	^{216}Po	7.18E–08	2.88E–06	2.07E–13	1.03E–09	4.32E–05	0.00%
^{218}Po	2.88E–10	1.8	5.18E–10	1.73E–07	^{218}Po	2.88E–10	2.88E–06	8.28E–16	4.13E–12	1.73E–07	0.00%
^{144}Pr	2.33E–10	1.8	4.19E–10	1.40E–07	^{144}Pr	2.33E–10	2.88E–06	6.70E–16	3.34E–12	1.40E–07	0.00%
^{144m}Pr	2.79E–12	1.8	5.03E–12	1.68E–09	^{144m}Pr	2.79E–12	2.88E–06	8.04E–18	4.01E–14	1.68E–09	0.00%
^{236}Pu	6.52E–09	1.8	1.17E–08	3.93E–06	^{236}Pu	6.52E–09	2.88E–06	1.88E–14	9.37E–11	3.93E–06	0.00%
^{238}Pu	[d]		9.23E–03	3.09E+00	^{238}Pu	[e]		5.85E–08	2.92E–04	3.09E+00	0.48%
^{239}Pu	[d]		2.75E–03	9.20E–01	^{239}Pu	[e]		9.36E–09	4.67E–05	9.20E–01	0.14%
^{240}Pu	6.06E–04	1.8	1.09E–03	3.65E–01	^{240}Pu	6.06E–04	2.88E–06	1.75E–09	8.71E–06	3.65E–01	0.06%
^{241}Pu	8.75E–03	1.8	1.58E–02	5.27E+00	^{241}Pu	[e]		3.75E–08	1.87E–04	5.27E+00	0.82%
^{242}Pu	4.43E–07	1.8	7.98E–07	2.67E–04	^{242}Pu	4.43E–07	2.88E–06	1.28E–12	6.37E–09	2.67E–04	0.00%
^{243}Pu	1.22E–16	1.8	2.20E–16	7.34E–14	^{243}Pu	1.22E–16	2.88E–06	3.51E–22	1.75E–18	7.34E–14	0.00%
^{244}Pu	2.94E–14	1.8	5.29E–14	1.77E–11	^{244}Pu	2.94E–14	2.88E–06	8.47E–20	4.22E–16	1.77E–11	0.00%
^{223}Ra	1.20E–09	1.8	2.16E–09	7.21E–07	^{223}Ra	1.20E–09	2.88E–06	3.45E–15	1.72E–11	7.21E–07	0.00%
^{224}Ra	7.18E–08	1.8	1.29E–07	4.32E–05	^{224}Ra	7.18E–08	2.88E–06	2.07E–13	1.03E–09	4.32E–05	0.00%
^{225}Ra	5.61E–12	1.8	1.01E–11	3.37E–09	^{225}Ra	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{226}Ra	2.88E–10	1.8	5.18E–10	1.73E–07	^{226}Ra	2.88E–10	2.88E–06	8.28E–16	4.13E–12	1.73E–07	0.00%

Table A-11. (continued).

	Solids					Liquids				Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{228}Ra	1.73E–14	1.8	3.11E–14	1.04E–11	^{228}Ra	1.73E–14	2.88E–06	4.97E–20	2.48E–16	1.04E–11	0.00%
^{87}Rb	7.15E–10	1.8	1.29E–09	4.30E–07	^{87}Rb	7.15E–10	2.88E–06	2.06E–15	1.03E–11	4.30E–07	0.00%
^{102}Rh	2.46E–09	1.8	4.44E–09	1.48E–06	^{102}Rh	2.46E–09	2.88E–06	7.10E–15	3.54E–11	1.48E–06	0.00%
^{106}Rh	7.69E–09	1.8	1.38E–08	4.63E–06	^{106}Rh	7.69E–09	2.88E–06	2.21E–14	1.10E–10	4.63E–06	0.00%
^{219}Rn	1.20E–09	1.8	2.16E–09	7.21E–07	^{219}Rn	1.20E–09	2.88E–06	3.45E–15	1.72E–11	7.21E–07	0.00%
^{220}Rn	7.18E–08	1.8	1.29E–07	4.32E–05	^{220}Rn	7.18E–08	2.88E–06	2.07E–13	1.03E–09	4.32E–05	0.00%
^{222}Rn	2.88E–10	1.8	5.18E–10	1.73E–07	^{222}Rn	2.88E–10	2.88E–06	8.28E–16	4.13E–12	1.73E–07	0.00%
^{106}Ru	7.69E–09	1.8	1.38E–08	4.63E–06	^{106}Ru	7.69E–09	2.88E–06	2.21E–14	1.10E–10	4.63E–06	0.00%
^{125}Sb	[d]		5.55E–04	1.86E–01	^{125}Sb	[e]		1.95E–09	9.73E–06	1.86E–01	0.03%
^{126}Sb	1.41E–06	1.8	2.55E–06	8.51E–04	^{126}Sb	1.41E–06	2.88E–06	4.07E–12	2.03E–08	8.51E–04	0.00%
^{126m}Sb	1.01E–05	1.8	1.82E–05	6.08E–03	^{126m}Sb	1.01E–05	2.88E–06	2.91E–11	1.45E–07	6.08E–03	0.00%
^{79}Se	1.07E–05	1.8	1.93E–05	6.46E–03	^{79}Se	1.07E–05	2.88E–06	3.09E–11	1.54E–07	6.46E–03	0.00%
^{146}Sm	4.65E–12	1.8	8.36E–12	2.80E–09	^{146}Sm	4.65E–12	2.88E–06	1.34E–17	6.67E–14	2.80E–09	0.00%
^{147}Sm	1.81E–10	1.8	3.26E–10	1.09E–07	^{147}Sm	1.81E–10	2.88E–06	5.22E–16	2.60E–12	1.09E–07	0.00%
^{148}Sm	9.30E–16	1.8	1.67E–15	5.60E–13	^{148}Sm	9.30E–16	2.88E–06	2.68E–21	1.34E–17	5.60E–13	0.00%
^{149}Sm	8.26E–17	1.8	1.49E–16	4.97E–14	^{149}Sm	8.26E–17	2.88E–06	2.38E–22	1.19E–18	4.97E–14	0.00%
^{151}Sm	7.71E–03	1.8	1.39E–02	4.64E+00	^{151}Sm	7.71E–03	2.88E–06	2.22E–08	1.11E–04	4.64E+00	0.72%
^{119m}Sn	9.55E–15	1.8	1.72E–14	5.75E–12	^{119m}Sn	9.55E–15	2.88E–06	2.75E–20	1.37E–16	5.75E–12	0.00%
^{121m}Sn	5.74E–05	1.8	1.03E–04	3.45E–02	^{121m}Sn	5.74E–05	2.88E–06	1.65E–10	8.24E–07	3.45E–02	0.01%
^{126}Sn	1.01E–05	1.8	1.82E–05	6.08E–03	^{126}Sn	1.01E–05	2.88E–06	2.91E–11	1.45E–07	6.08E–03	0.00%
^{90}Sr	[d]		1.87E–02	6.25E+00	^{90}Sr	[e]		1.83E–06	9.13E–03	6.26E+00	0.97%
^{98}Tc	6.34E–11	1.8	1.14E–10	3.82E–08	^{98}Tc	6.34E–11	2.88E–06	1.83E–16	9.12E–13	3.82E–08	0.00%
^{99}Tc	[d]		6.17E–04	2.06E–01	^{99}Tc	[e]		1.35E–09	6.74E–06	2.06E–01	0.03%
^{123}Te	5.12E–17	1.8	9.22E–17	3.08E–14	^{123}Te	5.12E–17	2.88E–06	1.48E–22	7.36E–19	3.08E–14	0.00%
^{125m}Te	1.43E–05		1.36E–04	4.55E–02	^{125m}Te	1.43E–05	2.88E–06	4.13E–11	2.06E–07	4.55E–02	0.01%

Table A-11. (continued).

Solids					Liquids					Total (Solids+Liquids)	
Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor[c]	(Ci/kg)	Total Solids Activity (Ci)	Nuclide	ORIGEN2[a,b]	^{137}Cs Ratio Factor	Ci/L	Total Liquids Activity (Ci)	Total Tank Activity (Ci)	Percent Total Activity
^{227}Th	1.18E–09	1.8	2.13E–09	7.11E–07	^{227}Th	1.18E–09	2.88E–06	3.40E–15	1.70E–11	7.11E–07	0.00%
^{228}Th	7.16E–08	1.8	1.29E–07	4.31E–05	^{228}Th	7.16E–08	2.88E–06	2.06E–13	1.03E–09	4.31E–05	0.00%
^{229}Th	5.61E–12	1.8	1.01E–11	3.37E–09	^{229}Th	5.61E–12	2.88E–06	1.61E–17	8.06E–14	3.37E–09	0.00%
^{230}Th	2.35E–08	1.8	4.24E–08	1.42E–05	^{230}Th	2.35E–08	2.88E–06	6.78E–14	3.38E–10	1.42E–05	0.00%
^{231}Th	7.93E–07	1.8	1.43E–06	4.77E–04	^{231}Th	7.93E–07	2.88E–06	2.28E–12	1.14E–08	4.77E–04	0.00%
^{232}Th	1.85E–14	1.8	3.33E–14	1.11E–11	^{232}Th	1.85E–14	2.88E–06	5.33E–20	2.66E–16	1.11E–11	0.00%
^{234}Th	8.17E–07	1.8	1.47E–06	4.92E–04	^{234}Th	8.17E–07	2.88E–06	2.35E–12	1.17E–08	4.92E–04	0.00%
^{207}Tl	1.19E–09	1.8	2.15E–09	7.19E–07	^{207}Tl	1.19E–09	2.88E–06	3.44E–15	1.72E–11	7.19E–07	0.00%
^{208}Tl	2.58E–08	1.8	4.65E–08	1.55E–05	^{208}Tl	2.58E–08	2.88E–06	7.43E–14	3.71E–10	1.55E–05	0.00%
^{209}Tl	1.21E–13	1.8	2.18E–13	7.29E–11	^{209}Tl	1.21E–13	2.88E–06	3.49E–19	1.74E–15	7.29E–11	0.00%
^{171}Tm	4.80E–16	1.8	8.63E–16	2.89E–13	^{171}Tm	4.80E–16	2.88E–06	1.38E–21	6.89E–18	2.89E–13	0.00%
^{232}U	6.91E–08	1.8	1.24E–07	4.16E–05	^{232}U	6.91E–08	2.88E–06	1.99E–13	9.93E–10	4.16E–05	0.00%
^{233}U	1.77E–09	1.8	3.19E–09	1.07E–06	^{233}U	1.77E–09	2.88E–06	5.11E–15	2.55E–11	1.07E–06	0.00%
^{234}U	[d]		2.98E–06	9.96E–04	^{234}U	3.37E–05	2.88E–06	9.71E–11	4.84E–07	9.97E–04	0.00%
^{235}U	7.93E–07	1.8	1.43E–06	4.77E–04	^{235}U	7.93E–07	2.88E–06	2.28E–12	1.14E–08	4.77E–04	0.00%
^{236}U	1.85E–06	1.8	3.33E–06	1.11E–03	^{236}U	1.85E–06	2.88E–06	5.33E–12	2.66E–08	1.11E–03	0.00%
^{237}U	2.15E–07	1.8	3.86E–07	1.29E–04	^{237}U	2.15E–07	2.88E–06	6.18E–13	3.08E–09	1.29E–04	0.00%
^{238}U	8.17E–07	1.8	1.47E–06	4.92E–04	^{238}U	8.17E–07	2.88E–06	2.35E–12	1.17E–08	4.92E–04	0.00%
^{240}U	2.94E–14	1.8	5.28E–14	1.77E–11	^{240}U	2.94E–14	2.88E–06	8.46E–20	4.22E–16	1.77E–11	0.00%
^{90}Y	[d]		1.87E–02	6.25E+00	^{90}Y	8.88E–01	2.88E–06	2.56E–06	1.28E–02	6.27E+00	0.97%
^{93}Zr	1.06E–04	1.8	1.90E–04	6.36E–02	^{93}Zr	1.06E–04	2.88E–06	3.04E–10	1.52E–06	6.36E–02	0.01%
			Total	645.8				Total	0.05	645.8	

a. Source: Wenzel 2005 (reports nuclide to ^{137}Cs ratios based on ORIGEN2 modeling and nuclide to ^{137}Cs ratios calculated from past analytical data).
b. From decay of parent sample data to 2012.
c. Average of ^{137}Cs data collected from the 1999 sampling of Tank WM-188.
d. Measured solid sample value from WM-183.
e. Measured liquid sample from Tank WM-186.

A-2. COMPARISION OF THE WM-182 POST-DECONTAMINATION RADIONUCLIDE INVENTORY TO THE PA INVENTORY

Results of post-decontamination sampling and analysis were used to determine the concentrations of the radioactive and hazardous constituents remaining in each tank. Analysis results were used to confirm that the radionuclide concentrations met the closure requirements, and that they were bounded by the concentrations assumed in the conservative inventory in the 2003 PA. Table A-12 presents a comparison between the estimated inventory at closure for Tank WM-182 and the conservative PA inventory for a single tank. The PA inventory was decayed to 2016 and the inventory at closure was decayed to 2012; because of this, it may be difficult to directly compare results for short-lived radionuclides. However, the total Ci remaining in the tank at closure are an order of magnitude lower than the amount estimated by the conservative PA inventory.

Table A-12. Comparison of post-decontamination estimated inventory for WM-182 and the performance assessment inventory.

Nuclide	Performance Assessment Conservative Inventory decayed to 2016 (Ci)				WM-182 Conservative Inventory decayed to 2012 (Ci)				Ratio WM-182 to PA
	Solids	Liquids	Total	Percent of Total	Solids	Liquids	Total	Percent of Total	
^{225}Ac	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{227}Ac	5.17E–06	8.58E–07	6.03E–06	0.00%	2.66E–06	1.33E–09	2.66E–06	0.00%	0.44
^{228}Ac	6.19E–11	1.03E–11	7.22E–11	0.00%	3.85E–11	1.92E–14	3.85E–11	0.00%	0.53
^{108}Ag	3.79E–08	6.29E–09	4.42E–08	0.00%	6.35E–10	3.17E–13	6.35E–10	0.00%	0.01
^{108m}Ag	0.00E+00	0.00E+00	0.00E+00	0.00%	7.13E–09	3.56E–12	7.13E–09	0.00%	NA
^{109m}Ag	0.00E+00	0.00E+00	0.00E+00	0.00%	5.30E–14	2.65E–17	5.30E–14	0.00%	NA
^{110}Ag	0.00E+00	0.00E+00	0.00E+00	0.00%	1.99E–15	9.93E–19	1.99E–15	0.00%	NA
^{110m}Ag	0.00E+00	0.00E+00	0.00E+00	0.00%	1.50E–13	7.47E–17	1.50E–13	0.00%	NA
^{241}Am	4.38E–01	1.79E–01	6.17E–01	0.00%	4.21E–01	5.30E–04	4.22E–01	0.02%	0.68
^{242}Am	1.34E–03	2.23E–04	1.56E–03	0.00%	1.59E–03	7.94E–07	1.59E–03	0.00%	1.02
^{242m}Am	1.34E–03	2.23E–04	1.56E–03	0.00%	1.60E–03	7.98E–07	1.60E–03	0.00%	1.02
^{243}Am	1.93E–03	3.19E–04	2.25E–03	0.00%	2.19E–03	1.09E–06	2.19E–03	0.00%	0.97
^{217}At	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{137m}Ba	3.44E+03	5.71E+02	4.01E+03	16.64%	1.14E+03	1.11E+00	1.14E+03	47.63%	0.28
^{10}Be	2.75E–07	4.56E–08	3.21E–07	0.00%	1.69E–07	8.41E–11	1.69E–07	0.00%	0.53
^{210}Bi	5.17E–07	8.58E–08	6.03E–07	0.00%	2.48E–07	1.24E–10	2.48E–07	0.00%	0.41
^{210m}Bi	2.00E–20	3.32E–21	2.33E–20	0.00%	1.21E–20	6.02E–24	1.21E–20	0.00%	0.52
^{211}Bi	5.17E–06	8.58E–07	6.03E–06	0.00%	2.67E–06	1.33E–09	2.67E–06	0.00%	0.44
^{212}Bi	1.72E–04	2.87E–05	2.01E–04	0.00%	1.60E–04	7.99E–08	1.60E–04	0.00%	0.80
^{213}Bi	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{214}Bi	1.21E–06	2.00E–07	1.41E–06	0.00%	6.41E–07	3.20E–10	6.41E–07	0.00%	0.45
^{14}C	1.10E–05	4.94E–01	4.94E–01	0.00%	4.90E–06	5.39E–08	4.95E–06	0.00%	0.00
^{109}Cd	0.00E+00	0.00E+00	0.00E+00	0.00%	5.30E–14	2.65E–17	5.30E–14	0.00%	NA
^{113m}Cd	1.65E–01	2.74E–02	1.92E–01	0.00%	1.29E–01	6.43E–05	1.29E–01	0.01%	0.67
^{142}Ce	2.75E–06	4.56E–07	3.21E–06	0.00%	1.63E–06	8.14E–10	1.63E–06	0.00%	0.51
^{144}Ce	5.50E–07	9.13E–08	6.41E–07	0.00%	5.18E–07	2.59E–10	5.18E–07	0.00%	0.81
^{249}Cf	1.55E–12	2.57E–13	1.81E–12	0.00%	1.61E–12	8.02E–16	1.61E–12	0.00%	0.89

Table A-12. (continued).

Nuclide	Performance Assessment Conservative Inventory decayed to 2016 (Ci)				WM-182 Conservative Inventory decayed to 2012 (Ci)				Ratio WM-182 to PA
	Solids	Liquids	Total	Percent of Total	Solids	Liquids	Total	Percent of Total	
^{250}Cf	6.55E–13	1.09E–13	7.64E–13	0.00%	8.31E–13	4.15E–16	8.31E–13	0.00%	1.09
^{251}Cf	2.44E–14	4.07E–15	2.85E–14	0.00%	2.55E–14	1.27E–17	2.55E–14	0.00%	0.90
^{252}Cf	0.00E+00	0.00E+00	0.00E+00	0.00%	1.08E–15	5.39E–19	1.08E–15	0.00%	NA
^{242}Cm	1.10E–03	1.83E–04	1.28E–03	0.00%	1.32E–03	6.58E–07	1.32E–03	0.00%	1.03
^{243}Cm	1.93E–03	3.19E–04	2.25E–03	0.00%	2.86E–04	1.43E–07	2.86E–04	0.00%	0.13
^{244}Cm	9.63E–02	1.60E–02	1.12E–01	0.00%	1.57E–02	7.82E–06	1.57E–02	0.00%	0.14
^{245}Cm	2.75E–05	4.56E–06	3.21E–05	0.00%	3.74E–06	1.87E–09	3.74E–06	0.00%	0.12
^{246}Cm	1.79E–06	2.97E–07	2.09E–06	0.00%	2.45E–07	1.23E–10	2.45E–07	0.00%	0.12
^{247}Cm	2.00E–12	3.32E–13	2.33E–12	0.00%	2.72E–13	1.36E–16	2.72E–13	0.00%	0.12
^{248}Cm	2.17E–12	3.59E–13	2.53E–12	0.00%	2.87E–13	1.43E–16	2.87E–13	0.00%	0.11
^{60}Co	1.41E–01	6.96E–02	2.11E–01	0.00%	6.21E–02	4.12E–04	6.25E–02	0.00%	0.30
^{134}Cs	4.71E–02	6.04E–03	5.31E–02	0.00%	6.76E–02	3.37E–05	6.76E–02	0.00%	1.27
^{135}Cs	8.26E–02	1.37E–02	9.63E–02	0.00%	3.20E–02	1.60E–05	3.20E–02	0.00%	0.33
^{137}Cs	3.44E+03	5.71E+02	4.01E+03	16.64%	1.14E+03	1.11E+00	1.14E+03	47.63%	0.28
^{150}Eu	1.03E–06	1.71E–07	1.20E–06	0.00%	6.61E–07	3.30E–10	6.61E–07	0.00%	0.55
^{152}Eu	1.21E–01	2.00E–02	1.41E–01	0.00%	8.73E–02	4.36E–05	8.73E–02	0.00%	0.62
^{154}Eu	3.00E–01	9.10E–01	1.21E+00	0.01%	3.89E+00	3.19E–04	3.89E+00	0.16%	3.22
^{155}Eu	2.44E+00	1.12E–01	2.55E+00	0.01%	1.06E+00	5.27E–04	1.06E+00	0.04%	0.42
^{55}Fe	0.00E+00	0.00E+00	0.00E+00	0.00%	1.09E+00	5.43E–04	1.09E+00	0.05%	NA
^{221}Fr	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{223}Fr	7.23E–08	1.20E–08	8.43E–08	0.00%	3.68E–08	1.84E–11	3.68E–08	0.00%	0.44
^{152}Gd	1.34E–13	2.23E–14	1.56E–13	0.00%	7.97E–14	3.98E–17	7.97E–14	0.00%	0.51
^{153}Gd	0.00E+00	0.00E+00	0.00E+00	0.00%	9.26E–16	4.62E–19	9.26E–16	0.00%	NA
^{3}H	4.82E–01	8.01E–02	5.62E–01	0.00%	7.17E–01	1.66E–05	7.17E–01	0.03%	1.28
^{166m}Ho	4.13E–06	6.86E–07	4.82E–06	0.00%	2.51E–06	1.25E–09	2.51E–06	0.00%	0.52
^{129}I	2.24E–03[a]	3.71E–04[b]	2.61E–03	0.00%	7.73E–04	1.12E–06	7.74E–04	0.00%	0.30
^{115}In	8.94E–12	1.48E–12	1.04E–11	0.00%	6.13E–13	3.06E–16	6.13E–13	0.00%	0.06

Table A-12. (continued).

Nuclide	Performance Assessment Conservative Inventory decayed to 2016 (Ci)				WM-182 Conservative Inventory decayed to 2012 (Ci)				Ratio WM-182 to PA
	Solids	Liquids	Total	Percent of Total	Solids	Liquids	Total	Percent of Total	
^{138}La	1.79E–11	2.97E–12	2.09E–11	0.00%	1.04E–11	5.21E–15	1.04E–11	0.00%	0.50
^{93m}Nb	1.72E–01	2.87E–02	2.01E–01	0.00%	1.95E–01	9.72E–05	1.95E–01	0.01%	0.97
^{94}Nb	7.67E+00	1.71E–02	7.69E+00	0.03%	2.06E–01	4.03E–05	2.06E–01	0.01%	0.03
^{144}Nd	1.48E–10	2.46E–11	1.73E–10	0.00%	8.83E–11	4.41E–14	8.83E–11	0.00%	0.51
^{59}Ni	3.68E–02[a]	6.11E–03[b]	4.29E–02	0.00%	2.51E–02	1.25E–05	2.51E–02	0.00%	0.59
^{63}Ni	2.61E+00	4.34E–01	3.04E+00	0.01%	2.86E+00	1.43E–03	2.86E+00	0.12%	0.94
^{236}Np	0.00E+00	0.00E+00	0.00E+00	0.00%	4.91E–07	2.45E–10	4.91E–07	0.00%	NA
^{237}Np	5.92E–03	1.71E–03	7.63E–03	0.00%	4.70E–02	2.71E–07	4.70E–02	0.00%	6.16
^{238}Np	6.55E–06	1.09E–06	7.64E–06	0.00%	7.99E–06	3.99E–09	7.99E–06	0.00%	1.05
^{239}Np	1.93E–03	3.19E–04	2.25E–03	0.00%	2.19E–03	1.09E–06	2.19E–03	0.00%	0.97
^{240m}Np	6.19E–11	1.03E–11	7.22E–11	0.00%	6.54E–11	3.27E–14	6.54E–11	0.00%	0.91
^{231}Pa	8.94E–06	1.48E–06	1.04E–05	0.00%	4.73E–06	2.36E–09	4.73E–06	0.00%	0.45
^{233}Pa	2.69E–01	4.47E–02	3.14E–01	0.00%	4.70E–02	2.35E–05	4.70E–02	0.00%	0.15
^{234}Pa	2.44E–06	4.07E–07	2.85E–06	0.00%	2.37E–06	1.18E–09	2.37E–06	0.00%	0.83
^{234m}Pa	1.93E–03	3.19E–04	2.25E–03	0.00%	1.82E–03	9.09E–07	1.82E–03	0.00%	0.81
^{209}Pb	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{210}Pb	5.17E–07	8.58E–08	6.03E–07	0.00%	2.48E–07	1.24E–10	2.48E–07	0.00%	0.41
^{211}Pb	5.17E–06	8.58E–07	6.03E–06	0.00%	2.67E–06	1.33E–09	2.67E–06	0.00%	0.44
^{212}Pb	1.79E–04	2.97E–05	2.09E–04	0.00%	1.60E–04	7.99E–08	1.60E–04	0.00%	0.77
^{214}Pb	1.21E–06	2.00E–07	1.41E–06	0.00%	6.41E–07	3.20E–10	6.41E–07	0.00%	0.45
^{107}Pd	1.48E–03	2.46E–04	1.73E–03	0.00%	9.05E–04	4.52E–07	9.05E–04	0.00%	0.52
^{146}Pm	8.94E–04	1.48E–04	1.04E–03	0.00%	8.91E–04	4.45E–07	8.91E–04	0.00%	0.86
^{147}Pm	5.17E–01	8.58E–02	6.03E–01	0.00%	8.65E–01	4.32E–04	8.65E–01	0.04%	1.44
^{210}Po	5.17E–07	8.58E–08	6.03E–07	0.00%	2.40E–07	1.20E–10	2.40E–07	0.00%	0.40
^{211}Po	0.00E+00	0.00E+00	0.00E+00	0.00%	7.47E–09	3.73E–12	7.47E–09	0.00%	NA
^{212}Po	1.10E–04	1.83E–05	1.28E–04	0.00%	1.03E–04	5.12E–08	1.03E–04	0.00%	0.80
^{213}Po	3.44E–08	5.71E–09	4.01E–08	0.00%	1.22E–08	6.11E–12	1.22E–08	0.00%	0.30

Table A-12. (continued).

Nuclide	Performance Assessment Conservative Inventory decayed to 2016 (Ci)				WM-182 Conservative Inventory decayed to 2012 (Ci)				Ratio WM-182 to PA
	Solids	Liquids	Total	Percent of Total	Solids	Liquids	Total	Percent of Total	
^{214}Po	1.21E–06	2.00E–07	1.41E–06	0.00%	6.41E–07	3.20E–10	6.41E–07	0.00%	0.45
^{215}Po	5.17E–06	8.58E–07	6.03E–06	0.00%	2.67E–06	1.33E–09	2.67E–06	0.00%	0.44
^{216}Po	1.79E–04	2.97E–05	2.09E–04	0.00%	1.60E–04	7.99E–08	1.60E–04	0.00%	0.77
^{218}Po	1.21E–06	2.00E–07	1.41E–06	0.00%	6.41E–07	3.20E–10	6.41E–07	0.00%	0.45
^{144}Pr	5.50E–07	9.13E–08	6.41E–07	0.00%	5.18E–07	2.59E–10	5.18E–07	0.00%	0.81
^{144m}Pr	6.55E–09	1.09E–09	7.64E–09	0.00%	6.22E–09	3.11E–12	6.22E–09	0.00%	0.81
^{236}Pu	1.03E–05	1.71E–06	1.20E–05	0.00%	1.45E–05	7.26E–09	1.45E–05	0.00%	1.21
^{238}Pu	1.41E+01	2.84E+00	1.69E+01	0.07%	1.14E+01	2.47E–03	1.14E+01	0.48%	0.67
^{239}Pu	8.97E–01	3.52E–01	1.25E+00	0.01%	3.40E+00	2.44E–04	3.40E+00	0.14%	2.72
^{240}Pu	9.63E–01	1.60E–01	1.12E+00	0.00%	1.35E+00	6.74E–04	1.35E+00	0.06%	1.20
^{241}Pu	1.27E+01	2.11E+00	1.48E+01	0.06%	1.95E+01	5.89E–04	1.95E+01	0.81%	1.32
^{242}Pu	7.23E–04	1.20E–04	8.43E–04	0.00%	9.87E–04	4.93E–07	9.87E–04	0.00%	1.17
^{243}Pu	0.00E+00	0.00E+00	0.00E+00	0.00%	2.72E–13	1.36E–16	2.72E–13	0.00%	NA
^{244}Pu	6.19E–11	1.03E–11	7.22E–11	0.00%	6.55E–11	3.27E–14	6.55E–11	0.00%	0.91
^{223}Ra	5.17E–06	8.58E–07	6.03E–06	0.00%	2.67E–06	1.33E–09	2.67E–06	0.00%	0.44
^{224}Ra	1.79E–04	2.97E–05	2.09E–04	0.00%	1.60E–04	7.99E–08	1.60E–04	0.00%	0.77
^{225}Ra	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{226}Ra	1.21E–06	2.00E–07	1.41E–06	0.00%	6.41E–07	3.20E–10	6.41E–07	0.00%	0.45
^{228}Ra	6.19E–11	1.03E–11	7.22E–11	0.00%	3.85E–11	1.92E–14	3.85E–11	0.00%	0.53
^{87}Rb	2.69E–06	4.47E–07	3.14E–06	0.00%	1.59E–06	7.95E–10	1.59E–06	0.00%	0.51
^{102}Rh	3.44E–06	5.71E–07	4.01E–06	0.00%	5.49E–06	2.74E–09	5.49E–06	0.00%	1.37
^{106}Rh	1.10E–05	1.83E–06	1.28E–05	0.00%	1.71E–05	8.55E–09	1.71E–05	0.00%	1.33
^{219}Rn	5.17E–06	8.58E–07	6.03E–06	0.00%	2.67E–06	1.33E–09	2.67E–06	0.00%	0.44
^{220}Rn	1.79E–04	2.97E–05	2.09E–04	0.00%	1.60E–04	7.99E–08	1.60E–04	0.00%	0.77
^{222}Rn	1.21E–06	2.00E–07	1.41E–06	0.00%	6.41E–07	3.20E–10	6.41E–07	0.00%	0.45
^{106}Ru	1.10E–05	1.83E–06	1.28E–05	0.00%	1.71E–05	8.55E–09	1.71E–05	0.00%	1.33
^{125}Sb	4.48E–02	7.43E–03	5.22E–02	0.00%	6.87E–01	1.76E–03	6.89E–01	0.03%	13.19

Table A-12. (continued).

Nuclide	Performance Assessment Conservative Inventory decayed to 2016 (Ci)				WM-182 Conservative Inventory decayed to 2012 (Ci)				Ratio WM-182 to PA
	Solids	Liquids	Total	Percent of Total	Solids	Liquids	Total	Percent of Total	
^{126}Sb	5.17E–03	8.58E–04	6.03E–03	0.00%	3.15E–03	1.57E–06	3.15E–03	0.00%	0.52
^{126m}Sb	3.79E–02	6.29E–03	4.42E–02	0.00%	2.25E–02	1.12E–05	2.25E–02	0.00%	0.51
^{79}Se	4.13E–02	6.86E–03	4.82E–02	0.00%	2.39E–02	1.19E–05	2.39E–02	0.00%	0.50
^{146}Sm	2.54E–08	4.22E–09	2.96E–08	0.00%	1.04E–08	5.17E–12	1.04E–08	0.00%	0.35
^{147}Sm	6.88E–07	1.14E–07	8.02E–07	0.00%	4.04E–07	2.02E–10	4.04E–07	0.00%	0.50
^{148}Sm	3.44E–12	5.71E–13	4.01E–12	0.00%	2.07E–12	1.03E–15	2.07E–12	0.00%	0.52
^{149}Sm	3.13E–13	5.19E–14	3.65E–13	0.00%	1.84E–13	9.19E–17	1.84E–13	0.00%	0.50
^{151}Sm	2.81E+01	4.69E+00	3.28E+01	0.14%	1.72E+01	8.57E–03	1.72E+01	0.72%	0.52
^{119m}Sn	0.00E+00	0.00E+00	0.00E+00	0.00%	2.13E–11	1.06E–14	2.13E–11	0.00%	NA
^{121m}Sn	4.47E–03	7.43E–04	5.21E–03	0.00%	1.28E–01	6.38E–05	1.28E–01	0.01%	24.57
^{126}Sn	3.79E–02	6.29E–03	4.42E–02	0.00%	2.25E–02	1.12E–05	2.25E–02	0.00%	0.51
^{90}Sr	7.59E+03	4.07E+02	8.00E+03	33.18%	2.32E+01	2.41E–01	2.34E+01	0.98%	0.00
^{98}Tc	2.38E–07	3.94E–08	2.77E–07	0.00%	1.41E–07	7.06E–11	1.41E–07	0.00%	0.51
^{99}Tc	8.97E–01[a]	1.49E–01[b]	1.05E+00	0.00%	7.64E–01	4.54E–05	7.64E–01	0.03%	0.73
^{123}Te	3.44E–14	5.71E–15	4.01E–14	0.00%	1.14E–13	5.70E–17	1.14E–13	0.00%	2.84
^{125m}Te	1.14E–02	1.89E–03	1.33E–02	0.00%	1.68E–01	1.59E–05	1.68E–01	0.01%	12.64
^{227}Th	5.17E–06	8.58E–07	6.03E–06	0.00%	2.63E–06	1.31E–09	2.63E–06	0.00%	0.44
^{228}Th	1.79E–04	2.97E–05	2.09E–04	0.00%	1.60E–04	7.97E–08	1.60E–04	0.00%	0.77
^{229}Th	3.44E–08	5.71E–09	4.01E–08	0.00%	1.25E–08	6.24E–12	1.25E–08	0.00%	0.31
^{230}Th	8.26E–05	1.37E–05	9.63E–05	0.00%	5.24E–05	2.62E–08	5.24E–05	0.00%	0.54
^{231}Th	1.93E–03	3.19E–04	2.25E–03	0.00%	1.77E–03	8.82E–07	1.77E–03	0.00%	0.79
^{232}Th	6.55E–11	1.09E–11	7.64E–11	0.00%	4.12E–11	2.06E–14	4.12E–11	0.00%	0.54
^{234}Th	1.93E–03	3.19E–04	2.25E–03	0.00%	1.82E–03	9.09E–07	1.82E–03	0.00%	0.81
^{207}Tl	5.17E–06	8.58E–07	6.03E–06	0.00%	2.66E–06	1.33E–09	2.66E–06	0.00%	0.44
^{208}Tl	6.19E–05	1.03E–05	7.22E–05	0.00%	5.75E–05	2.87E–08	5.75E–05	0.00%	0.80
^{209}Tl	7.57E–10	1.26E–10	8.83E–10	0.00%	2.70E–10	1.35E–13	2.70E–10	0.00%	0.31
^{171}Tm	4.13E–13	6.86E–14	4.82E–13	0.00%	1.07E–12	5.34E–16	1.07E–12	0.00%	2.22

Table A-12. (continued).

Nuclide	Performance Assessment Conservative Inventory decayed to 2016 (Ci) Solids	Liquids	Total	Percent of Total	WM-182 Conservative Inventory decayed to 2012 (Ci) Solids	Liquids	Total	Percent of Total	Ratio WM-182 to PA
^{232}U	1.72E–04	2.87E–05	2.01E–04	0.00%	1.54E–04	7.69E–08	1.54E–04	0.00%	0.77
^{233}U	2.23E–05	3.72E–06	2.60E–05	0.00%	3.95E–06	1.97E–09	3.95E–06	0.00%	0.15
^{234}U	7.57E–02	1.26E–02	8.83E–02	0.00%	3.69E–03	3.08E–06	3.69E–03	0.00%	0.04
^{235}U	4.11E–04	5.99E–05	4.71E–04	0.00%	1.77E–03	8.82E–07	1.77E–03	0.00%	3.76
^{236}U	3.06E–03	3.24E–05	3.09E–03	0.00%	4.12E–03	2.06E–06	4.12E–03	0.00%	1.33
^{237}U	3.19E–04	5.31E–05	3.72E–04	0.00%	4.78E–04	2.39E–07	4.78E–04	0.00%	1.29
^{238}U	2.44E–04	8.18E–05	3.26E–04	0.00%	1.82E–03	9.09E–07	1.82E–03	0.00%	5.59
^{240}U	6.19E–11	1.03E–11	7.22E–11	0.00%	6.54E–11	3.27E–14	6.54E–11	0.00%	0.91
^{90}Y	7.59E+03	4.07E+02	8.00E+03	33.18%	2.32E+01	2.41E–01	2.34E+01	0.98%	0.00
^{93}Zr	2.00E–01	3.32E–02	2.33E–01	0.00%	2.36E–01	1.18E–04	2.36E–01	0.01%	1.01
Total	22,133	1,969	24,103		2,393	3	2,396		0.10

NA=Not Applicable. Data for this radionuclide were not available in the PA inventory; therefore, a ratio cannot be calculated.
a. Measured liquid sample from Tank WM-186.
b. Measured solid sample value from WM-183.

A-3. POST-DECONTAMINATION INTERIOR TANK PHOTOGRAPHS FOR 300,000-GAL TANKS

Photographs of the 300,000-gal tanks were taken before and after decontamination to provide additional information on the extent of the decontamination process. Post-decontamination photos show that only isolated areas of solid residuals remain on the floors of the tanks (see Figures A-1 through A-7). Photographs of the 30,000-gal tanks are not included since photograph-quality cameras and lights could not be placed in the tanks as part of the video inspection.

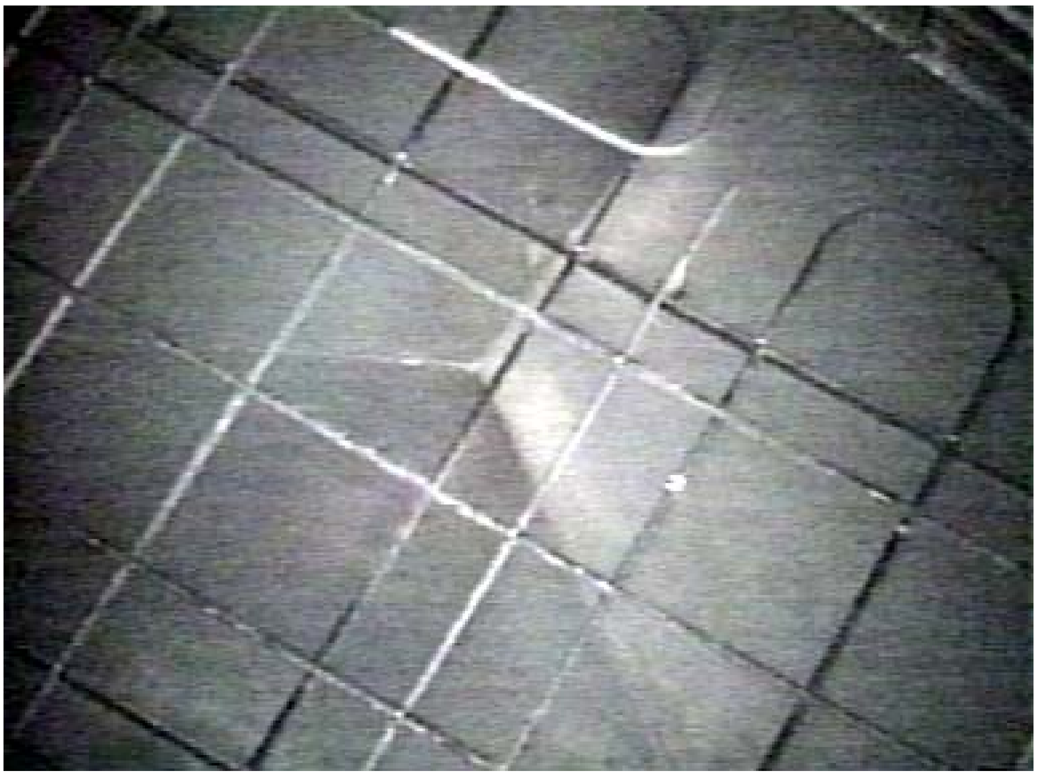

Figure A-1. TFF Tank WM-180 post-decontamination interior.

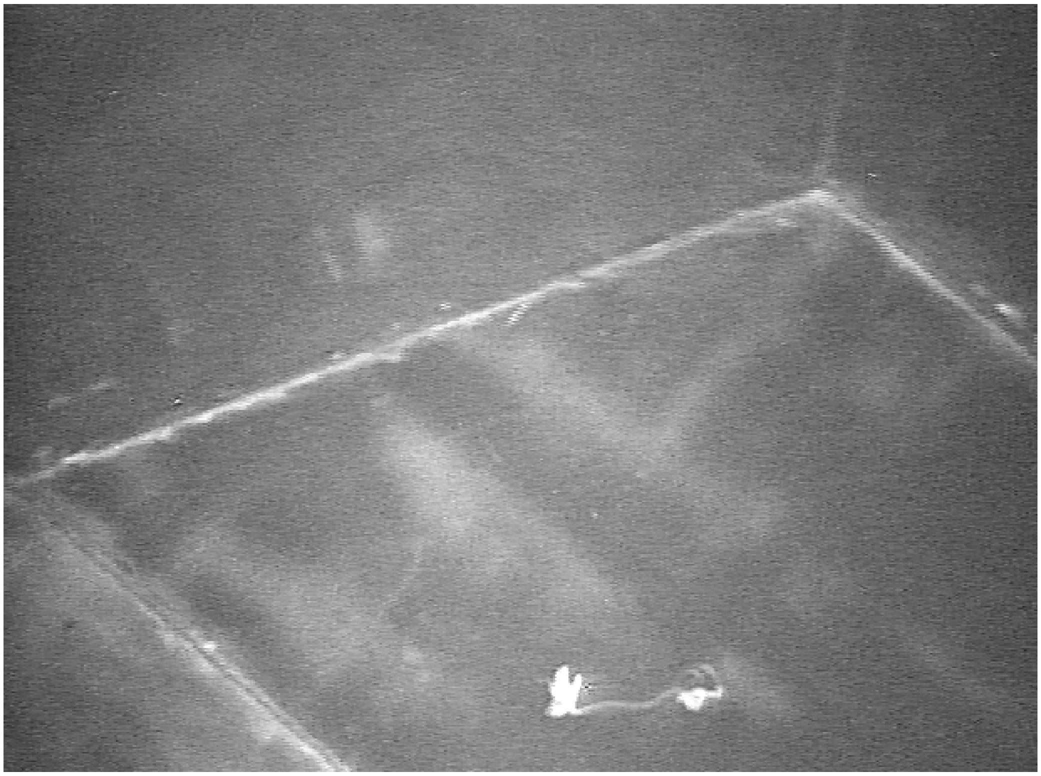

Figure A-2. TFF Tank WM-181 post-decontamination interior.

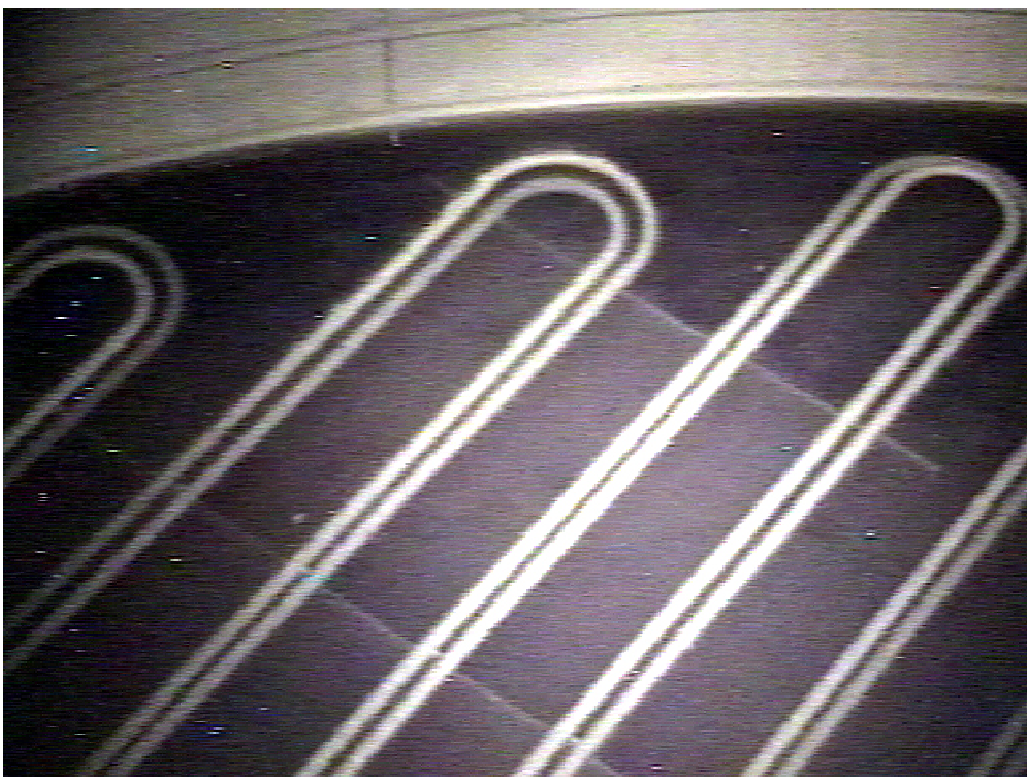

Figure A-3. TFF Tank WM-182 post-decontamination interior.

Figure A-4. TFF Tank WM-183 post-decontamination interior.

Figure A-5. TFF Tank WM-184 post-decontamination interior.

Figure A-6. TFF Tank WM-185 post-decontamination interior.

Figure A-7. TFF Tank WM-186 post-decontamination interior.

A-4. ALTERNATIVE RADIONUCLIDE CONCENTRATION CALCULATIONS

Radionuclide concentrations for piping were calculated using only the mass of the steel piping, but not the volume of the grout. These concentrations are shown in Tables A-13 and A-14. Radionuclide concentrations were also calculated for the grouted waste form in the tanks, without including the mass of the steel in the tanks, as shown in Tables A-15 through A-18.

Table A-13. Radionuclide concentrations in the piping (without grout) (Table 1 of 10 Code of Federal Regulations [CFR] 61.55).

Radionuclide[a]	Half-Life (yr)	Piping Inventory (Ci)[b]	Piping Inventory in Ci/m^3	Piping Inventory in nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)[c]	Fraction of Class C Concentration Limit
^{241}Am	4.30E+02	5.30E–03		3.00E–01	100	0.0030
^{14}C	***5.70E+03***	***6.20E–08***	***2.80E–08***		***8***	***0.0000000035***
^{242}Cm	4.50E–01	1.70E–05		9.40E–04	20,000	0.000000047
^{129}I	***1.60E+07***	***9.70E–06***	***4.40E–06***		***0.08***	***0.000055***
^{94}Nb	***2.00E+04***	***2.60E–03***	***1.20E–03***		***0.2***	***0.0059***
^{59}Ni	***7.50E+04***	***3.10E–04***	***1.40E–04***		***220***	***0.00000065***
^{237}Np	2.10E+06	5.90E–04		3.40E–02	100	0.00034
^{238}Pu	8.80E+01	1.40E–01		8.20E+00	100	0.082
^{239}Pu	2.40E+04	4.30E–02		2.40E+00	100	0.024
^{240}Pu	7.00E+03	1.70E–02		9.60E–01	100	0.010
^{241}Pu	1.40E+01	2.40E–01		1.40E+01	3,500	0.0040
^{244}Pu	3.80E+05	1.20E–05		7.00E–04	100	0.0000070
^{99}Tc	***2.10E+05***	***9.60E–03***	***4.40E–03***		***3***	***0.0015***
Sum of the Fractions						**0.13**

a. Radionuclides shown in ***bold italics*** are concentration limits in units of Ci/m^3; remaining radionuclides are concentrations limits in units of nCi/g.
b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.
c. Table 1 of 10 CFR 61.55.

Table A-14. Radionuclide concentrations in the piping (without grout) (Table 2 of 10 CFR 61.55).

Radionuclide	Half-Life (yr)	Piping Inventory (Ci)[a]	Piping Inventory in Ci/m^3	Class C Concentration Limit (Ci/m^3)[b]	Fraction of Class C Concentration Limit
^{137}Cs	3.00E+01	1.40E+01	6.50E+00	4,600	0.0014
^{63}Ni	1.00E+02	3.60E–02	1.60E–02	700	0.000023
^{90}Sr	2.90E+01	2.90E–01	1.30E–01	7,000	0.000019
Sum of the Fractions					**0.0015**

a. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.
b. Table 2 of 10 CFR 61.55.

Table A-15. Radionuclide concentrations in the final Tank WM-182 grouted waste form (calculated without the mass of the steel tank) (Table 1 of 10 CFR 61.55).

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Tank Inventory in Ci/m^3	Tank Inventory in nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)[c]	Fraction of Class C Concentration Limit
^{241}Am	4.30E+02	4.20E–01		8.90E–01	100	0.0089
^{14}C	***5.70E+03***	***5.00E–06***	***2.20E–08***		***8***	***0.0000000028***
^{242}Cm	4.50E–01	1.30E–03		2.80E–03	20,000	0.00000014
^{129}I	***1.60E+07***	***7.70E–04***	***3.40E–06***		***0.08***	***0.000043***
^{94}Nb	***2.00E+04***	***2.10E–01***	***9.10E–04***		***0.2***	***0.0046***
^{59}Ni	***7.50E+04***	***2.50E–02***	***1.10E–04***		***220***	***0.00000051***
^{237}Np	2.10E+06	4.70E–02		1.00E–01	100	0.0010
^{238}Pu	8.80E+01	1.10E+01		2.40E+01	100	0.24
^{239}Pu	2.40E+04	3.40E+00		7.20E+00	100	0.072
^{240}Pu	7.00E+03	1.40E+00		2.90E+00	100	0.029
^{241}Pu	1.40E+01	1.90E+01		4.10E+01	3,500	0.012
^{244}Pu	3.80E+05	9.90E–04		2.10E–03	100	0.000021
^{99}Tc	***2.10E+05***	***7.60E–01***	***3.40E–03***		***3***	***0.0011***
Sum of the Fractions						**0.37**

a. Radionuclides shown in ***bold italics*** are concentration limits in units of Ci/m^3; remaining radionuclides are concentration limits in units of nCi/g.
b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.
c. Table 1 of 10 CFR 61.55.

Table A-16. Radionuclide concentrations in the final Tank WM-182 grouted waste form (calculated without the mass of the steel tank) (Table 2 of 10 CFR 61.55).

Radionuclide	Half-Life (yr)	Tank Inventory (Ci)[a]	Tank Inventory in Ci/m^3	Class C Concentration Limit (Ci/m^3)[b]	Fraction of Class C Concentration Limit
^{137}Cs	3.00E+01	1.10E+03	5.10E+00	4,600	0.0011
^{63}Ni	1.00E+02	2.90E+00	1.30E–02	700	0.000018
^{90}Sr	2.90E+01	2.30E+01	1.00E–01	7,000	0.000015
Sum of the Fractions					**0.0011**

a. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.
b. Table 2 of 10 CFR 61.55.

Table A-17. Radionuclide concentrations in a final 30,000-gal tank grouted waste form (calculated without the mass of the steel tank) (Table 1 of 10 CFR 61.55).

Radionuclide[a]	Half-Life (yr)	30,000-gal Tank Inventory (Ci)[b]	30,000-gal Tank Inventory in Ci/m^3	30,000-gal Tank Inventory in nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)[c]	Fraction of Class C Concentration Limit
^{241}Am	4.30E+02	6.40E–03		5.30E–02	100	0.00053
^{14}C	***5.70E+03***	***1.10E–07***	***1.90E–09***		***8***	***0.00000000024***
^{242}Cm	4.50E–01	2.00E–05		1.70E–04	20,000	0.0000000083
^{129}I	***1.60E+07***	***1.20E–05***	***2.10E–07***		***0.08***	***0.0000026***
^{94}Nb	***2.00E+04***	***3.10E–03***	***5.50E–05***		***0.2***	***0.00027***
^{59}Ni	***7.50E+04***	***3.80E–04***	***6.70E–06***		***220***	***0.000000030***
^{237}Np	2.10E+06	7.10E–04		5.90E–03	100	0.000059
^{238}Pu	8.80E+01	1.70E–01		1.40E+00	100	0.014
^{239}Pu	2.40E+04	5.10E–02		4.30E–01	100	0.0043
^{240}Pu	7.00E+03	2.00E–02		1.70E–01	100	0.0017
^{241}Pu	1.40E+01	2.90E–01		2.50E+00	3,500	0.00070
^{244}Pu	3.80E+05	1.50E–05		1.20E–04	100	0.0000012
^{99}Tc	***2.10E+05***	***1.20E–02***	***2.00E–04***		***3***	***0.000068***
Sum of the Fractions						**0.022**

a. Radionuclides shown in ***bold italics*** are concentration limits in units of Ci/m^3; remaining radionuclides are concentration limits in units of nCi/g.
b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.
c. Table 1 of 10 CFR 61.55.

Table A-18. Radionuclide concentrations in a final 30,000-gal tank grouted waste form (calculated without the mass of the steel tank) (Table 2 of 10 CFR 61.55).

Radionuclide	Half-Life (yr)	Tank Inventory (Ci)[a]	Tank Inventory in Ci/m^3	Class C Concentration Limit (Ci/m^3)[b]	Fraction of Class C Concentration Limit
^{137}Cs	3.00E+01	1.70E+01	3.00E–01	4,600	0.000066
^{63}Ni	1.00E+02	4.30E–02	7.60E–04	700	0.0000011
^{90}Sr	2.90E+01	4.50E–01	8.00E–03	7,000	0.0000011
Sum of the Fractions					**0.000068**

a. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.
b. Table 2 of 10 CFR 61.55.

A-5. REFERENCES

10 CFR 61, 2004, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, Office of the Federal Register, January 1, 2004.

Wenzel, D. R., 2005, "Relative Inventories of Reactor-Produced Species in INTEC Waste Types," EDF-CRPD-001, Rev. 2, February 24, 2005.

Appendix B

Summary of Analysis for Selecting Tank Cleaning Technologies

Appendix B

Summary of Analysis for Selecting Tank Cleaning Technologies

In making the cleaning process technology selection for the Tank Farm Facility (TFF), the Idaho National Laboratory (INL) Site was part of a larger group called the Tanks Focus Area (TFA) technical team. The U.S. Department of Energy (DOE) commissioned this team to coordinate technology needs for the DOE complex-wide highly radioactive tank waste remediation problems. The team was established in 1995 for developing cleaning technologies and coordinating the tank cleanup effort among the DOE sites.

B-1. TECHNOLOGIES EVALUATED

The TFA coordinated with all DOE sites to develop cleaning processes based on site needs. The equipment developed had to fit inside the tanks, be compatible with the tank environment, and be able to clean the specific tank waste. Tank cleaning can be accomplished using either chemical or mechanical processes.

Chemical processes that the TFA developed include:

- Solids Washing—A chemical process for washing with Fenton's Reagent (a mixture of hydrogen peroxide with an Fe catalyst) that destroys ion exchange resin to release waste absorbed on the resin and allows it to be treated for disposal.

- Enhanced Solid Washing—A chemical process that involves a series of washes where tank waste is mixed with aqueous solutions containing sodium hydroxide, heated, cooled, and then the liquid, which contains the nonradioactive elements, is decanted.

- Chemical Cleaning—A process using various organic acids, possibly combined with caustic leaching to remove Al compounds, to dissolve portions of dense heel solids. By breaking up the solid mass, the resulting slurry can then be pumped out of the tank.

Mechanical processes include:

- Mixer Pumps—High-pressure pumps that intake and discharge solids in the tank bottoms to slurry the mixture and allow it to be pumped from the tank. Various systems were developed and tested, including:

    - A heavy waste retrieval system at the Oak Ridge Site

    - An advanced-design mixer pump at the Savannah River Site

    - A Flyght mixer at the Savannah River Site.

- Sluicing Systems—High-pressure water systems that slurry the solids and move it toward discharge pumps:

    - An enhanced sluicing system at the Hanford Site

    - A water mouse at the Savannah River Site

- A washball at the INL Site
- Directional nozzles at the INL Site
- A confined sluicing end effector at several DOE sites.

- Disposable Crawler—Commercially developed motorized treads that break up and mobilize the solids. A sluicer mounted on top of the motorized treads then uses a high-pressure water jet to move the loosened material toward the transfer pump.

- Mechanical Arms—Robotic arms installed through tank risers that are capable of deploying in-tank surveillance, confined sluicing, inspection, and waste analysis tools called end effectors:
  - Light-duty utility arm at the INL Site, the Hanford Site, and the Oak Ridge Site
  - Advanced Waste Retrieval System at the West Valley Demonstration Project.

B-2. INL SITE TECHNOLOGY EVALUATION

Because TFF tanks were considered with all tanks in the entire DOE complex, much of the work accomplished to clean other site tanks was applicable to the TFF tanks. Lessons were learned from technologies developed for other sites, even when the technology was not directly applicable to the TFF tanks. As a result of the TFA and the complex-wide effort at tank cleaning, the INL Site did not need to accomplish a lot of basic research on tank cleaning technologies. Rather, the INL Site was able to build on proven technologies and improve them for INL Site-specific needs. However, basic differences exist between the TFF waste and waste from other sites. The INL Site waste is acidic and contains few solids, whereas waste from other sites is non-acidic and contains many solids, most of which precipitated when the waste was neutralized for storage. Because of these differences, not all TFA-developed technologies were applicable at the INL Site. The INL Site participated with the TFA, evaluated TFA and other technologies, and determined that mechanical, rather than chemical, cleaning was applicable.

Through evaluation and the process of elimination, the INL Site determined that chemical processes were not practical for cleaning the TFF tanks. Caustic recycle, solids washing, and saltcake dissolution were developed for the neutralized waste at other DOE sites and did not apply to the TFF acid waste. Chemical cleaning was not practical for TFF waste because an acid that was strong enough to dissolve the solids could cause tank corrosion. Washing the solids in a basic solution could cause more precipitates, which would further aggravate the solids problem. Based on this evaluation, the INL Site did not pursue chemical cleaning.

The INL Site determined that some, but not all, mechanical cleaning systems were applicable for cleaning tanks. Mixer pumps were developed to slurry large solids volumes and were not appropriate for INL Site use because the TFF tanks contain relatively few solids. Mechanical robots that clean material from the tank floor were not practical because they could not crawl over the cooling coils on some of the TFF tanks. However, sluicing systems and mechanical arms were compatible with the TFF tanks. Sluicing systems were practical for removing the small quantity of solids from the tank walls and for slurrying the relatively thin layer of solids on the tank bottoms. A mechanical arm could hold a video camera for in-tank inspections and could operate equipment for sampling tank residuals.

The washball and a directional nozzle were determined to be best for cleaning the tank walls and slurrying solids on the tank bottoms. The washball was developed commercially by the chemical and oil industries for tank cleaning. The TFA introduced it to the DOE complex, and the INL Site has deployed it for cleaning the TFF tanks. The INL Site borrowed directional nozzle technology from the TFA and other sites to develop a remotely operable sluicing system that consists of a high-pressure spray nozzle, lights, and video camera that can be extended into a tank on a long pipe (PNNL 2001). The INL Site has deployed two high-pressure spray-nozzle sluicing systems for tank cleaning.

The INL Site tank cleaning system was tested in a full-scale mockup tank using simulated waste prior to deploying the unit for use in the tanks. The washball/directional nozzle tank cleaning system and the modified steam-jet pumping system were used to transfer slurried solid and liquid waste from the tanks. (The steam jet was modified by cutting the steam-supply line and installing a new steam jet lower in the tanks.) As a result of this development work and in-tank use of the washball, directional nozzle, light-duty utility arm, and modified steam-jet pumping system, the INL Site has created an efficient and effective tank cleaning system.

B-3. INL SITE TANK CLEANING

Tanks that will be closed by the TFF Closure Project include 11 300,000-gal tanks and four 30,000-gal tanks. One of the 300,000-gal tanks has never been used to store high-level waste and contains only a small quantity of slightly contaminated water. Contaminated lines, encasements, and valve boxes will also be cleaned, and for the purposes of calculating radionuclide removal costs, their cleaning will be considered as part of tank cleaning. During washball and directional nozzle operations, the steam-jet ejectors will operate to remove the waste-containing slurry from the tank. The goal of tank cleaning is to remove as much waste as practical. As an indication of cleaning effectiveness during this operation, radiation levels will be monitored on the steam-jet transport line (see Attachment B-1). Based on experience, when the radiation readings reach a certain level, the cleaning operation will be stopped and the tanks will be sampled to ascertain that they meet requirements for tank closure. However, if radiation levels are still dropping significantly, cleaning will continue. When radiation levels decrease to the lowest constant value, cleaning will be stopped and the tanks inspected and sampled to verify closure requirements are met (Kimmitt 2002).

B-4. WORKER DOSE

The INL Site has conducted tank cleaning on Tank WM-182 at the TFF. Cleaning operations for Tank WM-182 have included removing old equipment, installing tank cleaning and sampling equipment, and flushing with approximately 100,000 gal of water. Based on radiation exposure information on tank cleaning operations (Jacobson 2002) and a review of radiation work permit electronic dosimetry results for January 1, 2002, through June 15, 2005 (Martin 2005), the following is the estimated radiation exposure for cleaning a TFF tank.

Tank WM-182 cleaning occurred from mid-June to October 1, 2002. Filling Tank WM-182 with grout will result in a small additional exposure. The radiation exposures recorded in the Radiation Control Information Management System for 2002 tank closure activities for Tank WM-182 cleaning are a total of 611 mrem, including 15 mrem for removing equipment and preparing Tank WM-183 for a washball test (Jacobson 2002). Radiation exposures recorded for all TFF work performed January 1, 2002, through June 15, 2005, further reveal a total of 4,931 person-mrem. Maintenance-related process line and valve work for this period account for 2,568 person-mrem or about 52% of the total worker exposure. If the entire balance of 2,363 person-mrem is attributed to tank cleaning for the seven tanks, this yields an average of 338 person-mrem for each tank. Since 338 person-mrem per tank is conservatively derived from all tank activities averaged over the 3.5 years and seven tanks, it is concluded that using the actual exposure of 611 person-mrem from cleaning the most contaminated tank (WM-182) is a reasonable dose projection for future tank cleaning (Martin 2005).

The program's as low as reasonably achievable goal for 2002 was 1.93 person-rem, of which the TFF Closure Project contributed 0.611 person-rem. Twenty-three personnel involved directly with tank cleaning received a radiation dose from TFF closure activities. The maximum exposure any worker has received from TFF closure activities is 117 mrem.

Based on this information, the following is concluded:

- The average radiation exposure that will be experienced for cleaning and closing each TFF tank is expected to total about 650 mrem for all occupational exposure
- The exposure per person for cleaning a TFF tank will be about 650 mrem divided by 23 people, which is about 30 mrem per person
- Maximum radiation exposure for an individual worker is estimated to be 120 mrem for cleaning a single TFF tank.

Worker dose for tank cleaning is minimal because all cleaning is accomplished remotely. Worker exposures would be limited to equipment installation and operation and maintenance activities on contaminated equipment. Worker exposure per tank is estimated to total approximately 650 mrem for 23 workers (30 mrem per worker), which results in a total exposure of about 7.15 rem for cleaning 11 300,000-gal tanks. Worker doses for complete tank removal are significant because the action would require a large project to excavate the tanks, cut them up, and package them for disposal. Worker exposure for complete removal of the TFF tank system is estimated to be 1,070 mrem/yr/worker for an average of 326 workers/year for an estimated 26 years for a total exposure of over 9,000 rem (INEEL 1998).

B-5. REFERENCES

INEEL, 1998, *ICPP Tank Farm Closure Study*, INEEL/EXT-97-01204, Rev. 0, Appendix A, February 1998.

Jacobson, V. L., INEEL, to K. Quigley, INEEL, October 30, 2002, "Radiation Exposures from Tank WM-182 Cleaning."

Kimmitt, R. R., INEEL, 2002, to V. L. Jacobson, INEEL, October 30, 2002, "Tank WM-182 Cleaning Effectiveness."

Martin, J. R., Portage, Inc., to K. Quigley, INL, July 7, 2005, "Review of Radiation Exposures for INEEL INTEC Tank Farm – January 2002–June 2005."

PNNL, 2001, *Technical Review of Retrieval and Closure Plans for the INEEL INTEC Tank Farm Facility*, PNNL UC-721, Pacific Northwest National Laboratory, Richland, Washington, September 2001.

Attachment B-1

Tank Cleanout Effectiveness

The following tank cleaning information is from Tank WM-182 cleaning operations. Since Tank WM-182 was the first INTEC TFF tank that was cleaned to levels required before grouting, these data are presented as representative of the tank cleaning process.

Tank WM-182 Cleaning Results

Throughout summer 2002, Tank WM-182 was cleaned as part of a State of Idaho-approved closure plan. Cleaning operations took place on 18 days over a 3- to 4-month period. The primary goal of the cleaning was to remove radioactivity and chemical contaminants from the tank. Now that the radioactivity has been removed to the maximum extent practical, the remaining contents will be grouted in place within the tank. Mockup tests have shown that the grouting process also moves much of the remaining liquids and solids to the ejector pump so they can be removed. (For a complete explanation of data and results, see Kimmitt [2002].)

Background

By July 1999, Tank WM-182 had been emptied to heel levels by removing as much sodium-bearing waste as possible. Based on the quantities of solids and liquid estimated from the in-tank video inspection and on sample results, the total Tank WM-182 radionuclide content was estimated to be 14,000 Ci in the solids and 13,800 Ci in the liquid before cleaning operations began.

Cleaning was accomplished by modifying the in-tank steam jet to lower it to within 3 cm (1 in.) of the tank floor, washing with clean high-pressure water, and pumping the slurried solids and diluted liquid from the tank. Tank WM-182 was cleaned using a washball and directional spray nozzles to rinse and slurry the solids. During cleaning operations, tank closure personnel operated the modified steam jet to remove as much of the slurried solids as practical.

Data Collection

Radioactivity being pumped from Tank WM-182 was monitored in the discharge piping in Valve Box C2. The detector was a calibrated, unshielded Geiger-Mueller counter mounted near the pipe. Output from the counter was recorded at counts per minute at periodic time intervals. No measurement or estimate of detector efficiency was available. The count rate data were provided to project personnel in the form of charts. Figure Att-B-1-1 is an example of the discharge pipe readings.

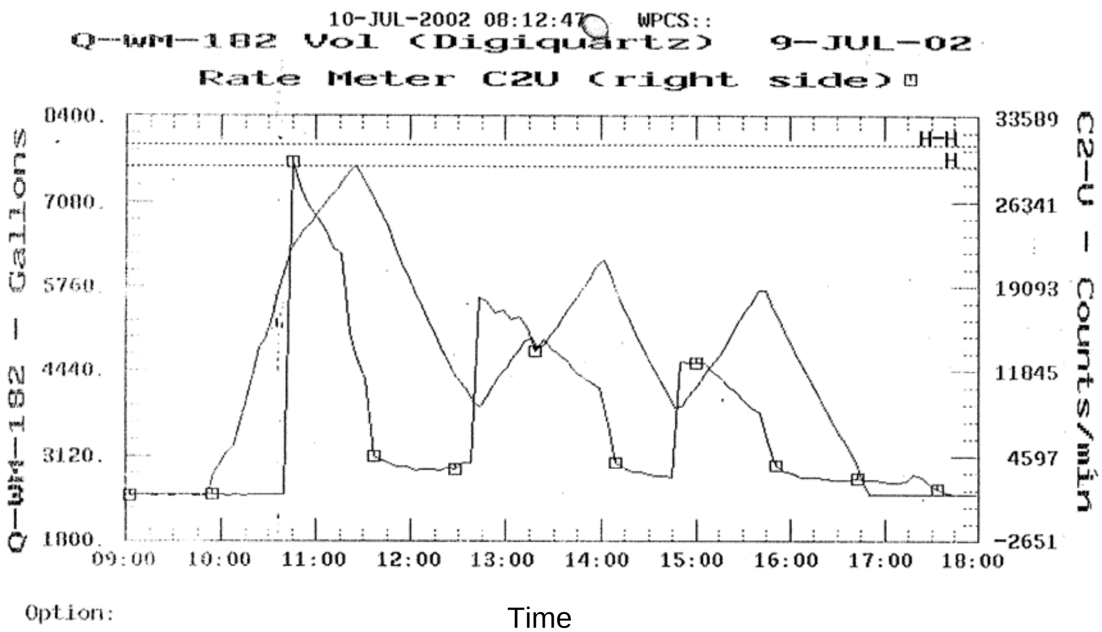

Figure Att-B-1-1. Discharge pipe radiation readings.

No discharge volume flow rate data were available. Therefore, the ejector was assumed to have operated continuously at 50 gpm during each cleaning session. Flow to the washball and directional spray nozzles was interrupted periodically to prevent the tank fluid level from rising above the desired range.

Data Analysis

To determine how the radioactivity content of Tank WM-182 was decreasing, an estimate of the radioactivity concentration of material being pumped from the vessel was necessary. The count rate was typically noted at 15-min intervals. From these values and the flow rate, a concentration term was calculated and plotted against cumulative volume of liquid pumped from the vessel. A background level was required to be subtracted from the count rate information. The background level was the starting count rate on each day before cleaning operations began. Figure Att-B-1-2 shows the resulting curve.

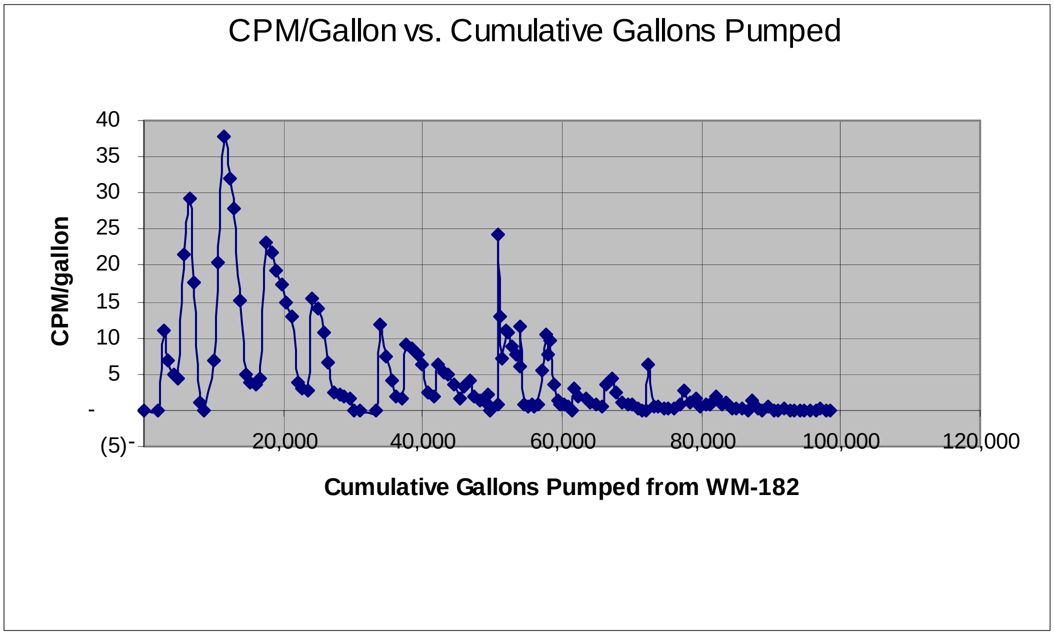

Figure Att-B-1-2. Radioactivity concentration [counts per minute per gallon] curve.

This figure shows that initially, a great deal of variability in the radioactivity per unit volume of water pumped existed. Drops occurred when the washwater was shut off and the suspended solids settled to the bottom of the tank. Once the washwater flow was restarted, the solids were re-suspended and pumped from the vessel. At first, only the washball was used, and it effectively stirred the solids. However, after approximately 30,000 gal had been introduced into the tank during several cleaning cycles, this device became far less effective. At approximately 50,000-gal cumulative volume introduced, two directional nozzles were substituted for the washball. Solids removal efficiency increased immediately but eventually tapered off again. By the time 90,000 gal of water had been pumped, essentially no additional radioactivity was being removed with the washwater. The gross Geiger-Mueller monitoring provided the cleaning personnel and management with a method to evaluate the need for additional cleaning.

Appendix C

Tank Farm Facility Grout Design Mix and Quality Assurance/Quality Control Testing

Appendix C

Tank Farm Facility Grout Design Mix and Quality Assurance/Quality Control Testing

The closure process for each tank includes removing most of the bulk sodium-bearing waste, grouting the tanks, vaults, and associated piping. (A final cover to be placed over the entire area upon completion of closure activities is anticipated, but this cover is not considered in analyses for this 3116 Basis Document.) The period between the first tank closure and final closure of the area is expected to be a minimum of 20 years. To meet closure requirements, each tank will be grouted with a Portland cement and fly ash-based grout. The grout formulas may change, but the general performance objectives will remain the same. Testing of the grout in the simulated conditions expected at tank closure has been performed and is documented in the *Grout Analysis Summary Report* (SAIC 2000). As further discussed in Appendix I, the U.S. Department of Energy (DOE) requires that its contractors develop and maintain a quality assurance (QA) program for radioactive waste management facilities, operations, and activities that meet the requirements of 10 Code of Federal Regulations (CFR) 830, Subpart A, “Quality Assurance Requirements,” and DOE Order 414.1C, “Quality Assurance” (2005), as applicable.

C-1. PERFORMANCE OBJECTIVES

Using grout in the tank closures provides long-term structural stability of the waste under the expected disposal conditions. If the final waste form is structurally stable, it will meet the following criteria (per 10 Code of Federal Regulations [CFR] 61):

- Prevent excessive subsidence, settlement, or deformation
- Minimize water infiltration
- Prevent radionuclide release from waste form disintegration
- Minimize the likelihood of waste intrusion.

Using grout in the tank closure process also provides a mechanical means for repositioning tank heels such that the waste residuals can more easily be removed from the tanks. The grout then serves to integrate and encapsulate the waste residuals. To accomplish this action, the grout must have the appropriate consistency and density to displace the waste. The grout must remain sufficiently flowable during placement.

The above uses are, in various instances, mutually exclusive. Specifically, increasing flowability is generally accompanied by a strength reduction and increased susceptibility to cracking. Based on the 1999 Idaho Nuclear Technology and Engineering Center grouting mockups, it is understood that flowability versus strength issues will be balanced by engineering the grout mix designs and placement sequencing (INEEL 2000, Book 1, Volume I, Chapter 16).

C-2. GROUT MIX DESIGN

Two basic grout mixtures have been developed for Tank Farm Facility (TFF) closure. The first (pipe grout) is a mixture of Portland cement, fly ash, water, and water-reducing admixtures. This mixture will be used to fill piping, small vessels, or other equipment that may require a very fluid grout. The other type of grout is tank and vault grout. They have the same basic mixture but differing volumes of constituents to account for differences in the required strength and the slump or flowability of the grout. The grout is expected to exhibit strongly reducing conditions, as do most concrete systems (DOE-ID 2003). Original grout designs did not include the addition of blast furnace slag, since TFF analysis concluded that reducing conditions in the grout are not necessary to demonstrate compliance with performance objectives (Portage 2005). Based on consultation with the NRC (RAI Clarifying Request 3 [NRC 2006]), the addition of reducing agents such as blast furnace slag was evaluated. DOE updated the basic mix design for engineered grout placements, encapsulation grout pours, and the first pours in the WM-185 and WM-187 vaults to add blast furnace slag to further ensure the establishment of a reducing environment. The vault grout is required to flow around at least half the circumference of the existing 15.2-m (50-ft) diameter tanks.

The flowability or fluidity of the mixtures is the main requirement for the grouts. This requirement has been measured in the past using standard concrete slump tests (ASTM International [ASTM] C 143/ C 143M). Approximately 23 cm (9 in.) of slump is required for all of the mixtures, and the pipe grout requires slumps of approximately 28 cm (11 in.). The tank grout must be able to move the tank waste residuals (both liquid and some solids) to locations where the wastes can more easily be removed from the tanks. For this reason, the tank grout needs to be less fluid than the other grout mixtures. Adjusting the quantity of water and admixtures is the easiest way to obtain the desired fluidity.

The base mix design for the tank and vault engineering grout pours is as follows (ICP 2006):

Cement	230 lb
Pozzolan (fly ash)	118 lb
Fine aggregate (sand)	2,500 lb
Ground blast furnace slag	352 lb
Water	Up to 400 lb (48 gal)
High-range water reducer	Up to 32 oz or as required to obtain slump and flow

The base mix design for the controlled low-strength material, which will be used to fill the tanks and vaults above the engineering grout pour volumes, is as follows:

Cement	75–100 lb	Type I & II cement
Pozzolan	200–300 lb	Fly ash
Fine aggregate	2,750–3,100 lb	Sand
Water	300–400 lb	(36–48 gal)
Medium-range water reducer	Up to 64 oz	
High-range water reducer	Up to 96 oz	

Grout placement tests associated with the first stage of the conceptual design shows that grout with a slump of more than 28 cm (11 in.) will flow halfway around the circumference of a 15.2-m (50-ft) diameter tank. Testing results indicate that all the mixtures are flowable and will achieve 28-day compressive strengths of at least 2,000 psi. Because of the high ash content of the mixtures, they continue to gain significant strength for a longer time period than is normal for typical construction grouts. The 56-day compressive strengths are approximately 1,000 psi stronger than the 28-day compressive strengths.

The base mix design for the pipe grout is as follows (EDF-1464, 2000):

Cement	680 lb	Type I & II cement
Pozzolan	1,600 lb	Fly ash
Water	Up to 800 lb	(96 gal)
Medium-range water reducer	Up to 32 oz	
High-range water reducer	Up to 64 oz	

The 28- and 56-day compressive strengths for the pipe grout mixture (using later tests based on 91 gal of water per yd^3) are 3,360 and 4,680 psi, respectively. The lowest 28-day test compressive strength for the pipe grout mixture tests is 2,400 psi (EDF-1464, 2000).

The slump of the pipe grout as tested by ASTM C 143/C 143M was in excess of 29 cm (11.4 in.). For larger pipes, it may be possible to reduce the water content of the mixture, and thus, reduce the shrinkage and bleed water associated with the high water content. Bleed water amounts from past tests of the mixture were low.

C-3. MANUFACTURING QUALITY CONTROL

The grout supplier will provide and manufacture grout according to the following requirements (INEEL 2000, Section 16):

- Cement, Sand, Blast Furnace Slag, and Fly Ash
  - ASTM C 150 — Standard Specification for Portland Cement
  - ASTM C 618 — Standard Specification for Coal Fly Ash or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
  - ASTM C 989 — Standard Specification for Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars
- Chemical Admixtures
  - ASTM C 494/C 494M — Standard Specification for Chemical Admixtures for Concrete
  - ASTM C 1017/C 1017M — Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

C-4. MANUFACTURING QUALITY ASSURANCE

Manufacturing QA will be conducted by an engineer and generally includes the following:

- Review documentation stating the supplier's qualifications, capabilities, licenses, certifications, etc.
- Periodic inspections of the manufacturing plant
- Verification that substantive requirements of manufacturing quality control are being met

- Construction quality control.

The construction quality control procedures include activities such as delivery cycles, truck waiting time limitations, mixing revolutions, water and admixture measurements, and any other procedures that are used to meet the project specifications consistently (INEEL 2000, Section 16).

C-5. CONSTRUCTION QUALITY ASSURANCE

Construction QA activities conducted by the engineer at the project site consist of the following:

- Observe and record the contractor's activities and construction quality control procedures

- Receive batch tickets, and randomly verify that delivery meets project specifications

- Provide adequate grout samples for field and laboratory testing per applicable ASTM standards

- Field test grout per applicable ASTM standards.

The ASTM standards or equivalents for controlled low-strength material for construction QA include:

- Sampling Procedures

  - ASTM C 31/C 31M — Standard Practice for Making and Curing Concrete Test Specimens in the Field

  - ASTM C 172 — Standard Practice for Sampling Freshly Mixed Concrete

- Grout Testing

  - ASTM C 143/C 143M — Standard Test Method for Slump of Hydraulic-Cement Concrete

  - ASTM C 939 — Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

  - ASTM C 1064/C 1064M — Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

Periodic tests will be conducted at the engineer’s discretion to verify that the delivered grout used throughout the TFF closure project has compressive strength properties similar to preliminary design values and remains consistent over time. Tests on representative samples will be conducted per ASTM C 39, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens* (INEEL 2000, Section 16).

C-6. QUALITY ASSURANCE TESTING SUMMARY

Table C-1 is a summary of the QA tests and procedures that are projected for the TFF closure grouting project. They are based on concrete construction industry standards of practice.

Table C-1. Summary of QA Tests for Grouting (INEEL 2000, Section 16).

QA Test or Procedure	Standards	Frequency and Time, Other Notes
Review supplier's qualifications	NA	Once, prior to beginning work
Inspect batch plant	NA	Quarterly for the project duration, more frequently if grout inconsistencies are noted
Check compliance with manufacturing standards	ASTM C 150 ASTM C 494/ C 494M ASTM C 618 ASTM C 1017/ C 1017M	These checks will be performed as part of the batch plant inspections
Observe and record contractor's activities and quality control procedures	NA	Continuously through project duration, prepare daily logbooks, weekly reports, and monthly reports
Measure grout temperature	ASTM C 1064/ C 1064M	One per day
Measure grout slump or time of efflux	ASTM C 143/ C 143M ASTM C 939	One per day
Collect grout test specimens	ASTM C 31/C 31M ASTM C 172	Collect representative cylinders for further testing if engineer determines necessary.
Perform compressive strength tests	ASTM C 39/C 39M	Collect representative cylinders for further testing if engineer determines necessary.

NA = Not applicable.

The water-to-cement ratio is the chief factor for determining grout strength. Therefore, careful measuring and testing of the mix during manufacturing and upon arrival at the job site is important to the final product. Because real-time physical characterization of the grout is needed prior to placement, grout samples are planned to be collected from the beginning of the truck discharge prior to placement. These samples are planned to be tested for slump (ASTM C 143/C 143M) and/or time of efflux (ASTM C 939). Although it is standard procedure to measure air content (ASTM C 231) in conjunction with field sampling of concrete, in this case air content measurements may be waived. Prior test data indicate very low values of air content for the proposed mix design, and these values are not expected to increase during the TFF grouting. In addition, entrained air is used to give grout freeze and thaw resistance, and frost is not anticipated in this design application.

C-7. REFERENCES

10 CFR 61, 2004, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, Office of the Federal Register, January 1, 2004.

ASTM C 31/C 31M, 2003, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*, Rev. A, ASTM International, February 10, 2003.

ASTM C 39/C 39M, 2004, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*, Rev. A, ASTM International, November 1, 2004.

ASTM C 143/C 143M, 2003, *Standard Test Method for Slump of Hydraulic-Cement Concrete*, ASTM International, July 10, 2003.

ASTM C 150, 2004, *Standard Specification for Portland Cement*, Rev. A, ASTM International, July 1, 2004.

ASTM C 172, 2004, *Standard Practice for Sampling Freshly Mixed Concrete*, ASTM International, June 1, 2004.

ASTM C 231, 2004, *Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method*, ASTM International, July 1, 2004.

ASTM C 494/C 494M, 2004, *Standard Specification for Chemical Admixtures for Concrete*, ASTM International, January 1, 2004.

ASTM C 618, 2003, *Standard Specification for Coal Fly Ash or Calcined Natural Pozzolan for Use in Portland Cement Concrete*, ASTM International, January 10, 2003.

ASTM C 939, 2002, *Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)*, ASTM International, December 10, 2002.

ASTM C 989, *Standard Specification for Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars*, ASTM International, August 1, 2006.

ASTM C 1017/C 1017M, 2003, *Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete*, ASTM International, December 1, 2003.

ASTM C 1064/C 1064M, 2005, *Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete*, ASTM International, January 1, 2005.

DOE Order 414.1C, 2005, "Quality Assurance," U.S. Department of Energy, June 17, 2005.

DOE-ID, 2003, *Performance Assessment for the Tank Farm Facility at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10966, Rev. 1, April 2003 (Errata December 2, 2003).

EDF-1464, 2000, "INTEC Tank Farm Closure Grout Mix Design," April 14, 2000.

ICP, 2006, *Response to Request for Additional Information on the Draft Section 3116 Determination Idaho Nuclear Technology and Engineering Center Tank Farm Facility*, ICP/EXT-06-01204, May 31, 2006.

INEEL, 2000, *INTEC Tank Farm Facility Closure Conceptual Design Report*, Project File No. 015722, September 29, 2000.

Portage, 2005, "Evaluation of ^{99}Tc Drinking Water Dose for Oxidizing Sorption Coefficient in the Tank Grout," PEI-EDF-1024, Rev. 0, Portage, Inc., Idaho Falls, Idaho, August 2005.

SAIC, 2000, *Grout Analysis Summary Report*, Science Applications International Corporation, August 11, 2000.

Appendix D

Sensitivity Evaluations

Appendix D

Sensitivity Evaluations

In addition to the previously described analyses, several additional evaluations have been performed to aid in understanding the sensitivity of residual inventory estimates, grout volumes, waste density, and other parameters. These additional evaluations are included in this appendix.

Following submittal of the draft 3116 Determination to NRC in September 2005, the NRC released a FR notice, "Draft Interim Concentration Averaging Guidance for Waste Determinations" (70 FR 74846), for public comment.

The draft interim guidance introduces a concept of ratios of unstabilized-to-stabilized waste. The factor of 10 is an approximation derived from a consideration that most stabilization techniques commonly envisioned use of cementitious materials, and most cementitious waste forms can readily achieve a 10% waste loading. This may be a close approximation for relatively small containers, of which stabilizing material can be easily manipulated without the operational constraints of large underground tanks.[a] However, as the factor of 10 is only guidance, other ratios should be considered, particularly in the case of tank waste and residuals. Additional stabilizing material should be considered as waste in a computation under 10 CFR 61 if it can be demonstrated that such material is stabilizing and containing the waste, but not being added merely for the purpose of diluting waste.

Given the depth of such stabilized waste, it does not appear likely that an individual intruder would be inadvertently exposed to such waste other than by drilling into it. Other inadvertent intruder scenarios, such as excavation for a basement of a house, would be unlikely due to the depth of the waste. In light of the nature of stabilized waste residues in tanks, the 10:1 ratio is unduly conservative.

The analyses in this appendix have been developed considering the specific features of the TFF tanks and ancillary equipment. The nature of the acidic waste and stainless steel tanks is unique to the DOE complex. Because the waste remained acidic, significant amounts of stiff, recalcitrant sludge do not remain in cleaned tanks. Methods used in this determination of waste concentrations are not likely to be used in the same manner by other DOE sites because the characteristics of the waste and tanks, and the general characteristics of individual DOE sites, are different.

To demonstrate a concentration averaging approach to an intruder-drilling scenario, a sensitivity analysis is performed in this appendix in which an intruder drills into the stabilized waste. The mass or volume of the drill cuttings to the bottom of the tank is used to prepare a sum of the fractions calculation.

---

a. It may also be as a result of the view expressed in NUREG-0945, *Final Environmental Impact Statement on 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste"* (NRC 1982), that when Class C waste is brought to the surface through an excavation scenario the degree of dilution of the disposed waste was estimated to be at least an order of magnitude.

D-1. SENSITIVITY ANALYSES FOR INVENTORY AND SUM OF THE FRACTIONS CALCULATIONS

The following sections provide sensitivity evaluations for the 300,000-gal tanks, tank vaults, and 30,000-gal tanks. These evaluations provide analysis of the radionuclide inventory, volume, and density of grout, and density of residual waste. Additional perspective on the final waste form concentrations is provided below.

D-1.1 Tank Inventory Defensibility

The mass of solids estimated in the cleaned tanks uses a conservative methodology. A discussion of the inventory in this section is augmented in the response to NRC Comment 2 (ICP 2006), which also addresses sensitivity of the tank inventory. Inventory information is presented here to demonstrate that tank inventory uncertainty is biased toward overestimation of total inventory and long-lived radionuclides, which are important to sum of the fractions calculations. As described in detail below, it is clear when the data for the important contributors to waste concentration are reviewed, the data are more defensible than would appear based on a single sample. The defensibility of the data is strengthened by solid sample data collected from three of the tanks prior to cleaning, which agree remarkably well with data collected after cleaning for relatively insoluble radionuclides. An additional sample was collected from WM-183 after the draft 3116 Determination was prepared. The results of this sample and other tank samples are discussed below and shown in Table D-1.

The inventory at closure and disposal in the TFF tanks described in Section 2 is based on the assumptions of the density of residual solids, measurements of interstitial liquid, and the measured concentrations of radionuclides. As described in Section 2 of this document, only one sample from the cleaned tank contained solids, and it was used to estimate the residual solids radioactivity in the draft 3116 Determination (as discussed further in the response to NRC Request for Additional Information [RAI] Comment 2 [ICP 2006]). Since the draft 3116 Determination was developed, an additional sample was collected from Tank WM-183 in 2005. This sample provides additional confidence in the data and inventory. Long-lived radionuclides, especially ^{238}Pu and ^{239}Pu, contribute significantly to the inventory for waste concentration calculations.

While the inventory in this document is based on one sample, the data from samples collected prior to cleaning were used as a foundation for the inventory. The data from all sampling events prior to cleaning, after cleaning, and the sample collected in 2005 are shown in Table D-1. The radionuclides have been decayed to 2012. The values in bold italics show the highest concentration of a radionuclide in any of the samples (either pre- or post-cleaning). The values in bold show the highest concentrations of either of the WM-183 solid samples. Examination of the data for the long-lived radionuclide ^{238}Pu shows the data are normally distributed and the calculated 95% upper confidence limit (UCL) is 1.19E–02 Ci/kg. This value is slightly greater the value used for the inventory. The mean is 8.64E–03, which is less than the inventory concentration of 9.15E–03. The data for ^{239}Pu are normally distributed and the calculated 95% UCL is 2.26E–03. The 95% UCL is slightly lower than the value used in Section 2 of this document.

Table D-1. Data collected for solid material in tanks (Ci/kg).

Radionuclide[a]	WM-183 Post-Cleaning Solids (2005)	WM-183 Post-Cleaning Solids	WM-182 Pre-Washed Solids	WM-183 Pre-Washed Solids	WM-188 Pre-Washed Solids	WM-188 Pre-Washed Solids	WM-188 Pre-Washed Solids	WM-188 Pre-Washed Solids
^{241}Am	3.33E–04	**3.34E–04**	*8.31E–04*	2.39E–04	1.48E–04	2.10E–04	2.59E–04	ND
^{60}Co	**5.94E–05**	5.72E–05	2.79E–05	3.79E–05	*1.14E–04*	ND	ND	ND
^{137}Cs	6.33E–01	**9.23E–01**	3.30E–01	6.81E–01	9.26E–01	1.97E+00	1.59E+00	*2.73E+00*
^{154}Eu	**5.16E–05**	3.20E–05	9.34E–05	*2.77E–04*	ND	ND	ND	ND
^{3}H	NA	NA	6.41E–06	*2.07E–05*	ND	ND	ND	ND
^{94}Nb	ND	1.66E–04	ND	ND	8.11E–04	*6.32E–03*	1.98E–03	5.62E–03
^{237}Np	*1.01E–05*	ND	1.66E–06	1.76E–06	4.68E–06	2.24E–06	1.62E–06	ND
^{238}Pu	**9.17E–03**	9.15E–03	*1.77E–02*	3.60E–03	6.24E–03	8.22E–03	6.44E–03	ND
^{239}Pu	*3.17E–03*	2.75E–03	1.47E–03	1.25E–03	3.32E–04	5.27E–04	4.30E–04	ND
^{90}Sr	1.28E–02	**1.87E–02**	1.78E–01	1.41E–01	3.62E+00	*5.82E+00*	2.53E+00	ND
^{99}Tc	1.10E–04	**6.17E–04**	2.63E–03	ND	*5.32E–03*	3.76E–03	4.41E–03	ND
^{234}U	NA	**2.98E–06**	ND	*3.38E–06*	ND	ND	ND	ND
^{129}I	*8.44E–07*	6.24E–07	ND	ND	ND	ND	ND	ND
^{14}C	*2.15E–05*	NA	NA	NA	NA	NA	NA	NA
^{63}Ni	*1.87E–04*	NA	4.14E–05	1.60E–04	NA	NA	NA	NA

NA = Not analyzed.

ND = Not detected.

a. Radionuclides decayed to 2012. The values in underlined italics show the highest concentration of a radionuclide in any of the samples (either pre- or post-cleaning). The values in bold show the highest concentrations of either of the WM-183 solid samples.

Examination of ^{238}Pu and ^{239}Pu data collected from Tank WM-183 after cleaning is important to establishing an inventory and performing the sum of the fractions calculations. It is not possible to use common statistical analysis of sample populations when only two samples have been collected. Statistical methods such as the t-test or analysis of variance require at least three degrees of freedom (n–1). As n (number of samples) increases, the confidence in the analysis increases. One degree of freedom is unacceptable for these analyses (EPA 2006a, 2006b). Therefore, a statistical method of assessing differences between radioactivity measurements and determining the significance of those differences is used for these samples. Generally, this method is used to evaluate the statistical difference between duplicate results and sample results. The method is applicable because it evaluates if two sample results are within the analytical error of the instrumentation and it infers that the sub-samples (in this case, samples) have been taken from the same sample. The use of this method is to show that the data from two sampling events are essentially identical.

The method of comparing duplicate analysis for radionuclides uses the mean difference calculation. That is, if a sample is split and duplicates are analyzed, the analysis is deemed to be within an acceptable error if the mean difference is less than 3. The mean difference equation is shown below.

$$MD = \frac{|S - D|}{\sqrt{\sigma_{S^2} + \sigma_{D^2}}} \tag{D-1}$$

MD = the mean difference of the duplicate results

S = the original sample result

D = the duplicate sample result

σ_S = the associated total propagated 1σ uncertainty of the original result (as a standard deviation)

σ_D = the associated total propagated 1σ uncertainty of the duplicate result (as a standard deviation).

The mean differences for ^{238}Pu and ^{239}Pu are 0.15 and 0.73, respectively. This is well below the threshold of 3 used in INL data validation methods (GDE-205, 2004). This indicates the samples are quite comparable. This result provides confidence in the data and tends to reduce uncertainty of the inventory for radioactive waste concentration calculations.

D-1.1.1 300,000-gal Tank Inventory Sensitivity

The inventory presented in the PA (DOE-ID 2003) and this earlier in document used a conservative density and, consequently, a conservative mass of residual solids. The data and assumptions used in calculation of the sum of the fractions in Tables 1 and 2 of 10 CFR 61.55 are listed below.

1. The inventory is based on a sample collected from Tank WM-183. An additional sample was collected in 2005. The inventory and sum of the fractions using the sample collected in 2005 are shown below.

2. The concentrations of radionuclides, which were not detected in the 2003 sample, were estimated using the ORIGEN2 numerical model. Radionuclide concentrations in Table 1 of 10 CFR 61.55, which were estimated based on ORIGEN2, include ^{14}C, ^{242}Cm, ^{59}Ni, ^{237}Np, ^{240}Pu, ^{241}Pu, and ^{242}Pu. ^{14}C and ^{237}Np were detected in the 2005 sample.

3. A ^{137}Cs concentration of 1.8 Ci/kg was used in the ORIGEN2/Wenzel ratios, rather than the ^{137}Cs concentration detected in the Tank WM-183 sample of 0.923 Ci/kg. This is a conservative ratio but has little impact on the sum of the fractions calculations.

4. The concentrations of ^{238}Pu and ^{239}Pu contribute approximately 85% of the sum of the fractions in Table 1 of 10 CFR 61.55.

5. The concentrations of radionuclides, which were not detected in the sample, were estimated using the ORIGEN2 numerical model. Radionuclide concentrations in Table 1 of 10 CFR 61.55, which were estimated based on ORIGEN2, only include 63Ni.

6. The concentration of ^{137}Cs contributes nearly 100% of the sum of the fractions for Table 2 of 10 CFR 61.55 (short-lived radionuclides). However, the sum of the fractions is 1.10E–03, which is significantly less than unity.

7. 118 m^3 of grout with a density of 2.1 g/cc were used in the calculation. There are 85 m^3 in the engineered grout placements and 33 m^3 in the encapsulation grout pour.

8. A total volume of 118 m^3 and a mass of 2.48E+08 g of grout were used in the calculation.

9. A mass of 1,238 kg of residual solids was used in the calculation.

10. A volume of 4,989 L of residual liquids was used in the calculation.

D-1.1.1.1 Residual Solids Density. The inventory discussed in Section 2 is based on radionuclide concentrations, as previously discussed. The measured and assumed density of residual solids and the measured interstitial liquids associated with the residual solids affect the density of solid residuals. Information on residual solids density, particle size, and interstitial liquids is based on analysis of samples collected prior to tank cleaning. The density of the residual solids is an additional source of uncertainty. The density of residual solids is estimated at 1.4 g/cc for inventory in the 3116 Determination and waste concentration calculations. However, measurements from sampling events indicate that the density is likely 1.20 g/cc or as high as 2 g/cc (INEEL 1999). Using a density of 1.2 g/cc equates to a 14% reduction in mass and subsequent reduction in inventory of all radionuclides, while using the density of 2 g/cc results in an increase of 40% in mass and inventory. A density of 2 g/cc is associated with air-dried residual solids (EDF-TST-001, 2000; WSRC 2002).

The data available on the sludge samples were based on the material resulting from air drying the sample, which results in the precipitation of any soluble solids present in the interstitial supernate. Thus, the air-dried sample that was analyzed was a composite of the insoluble and soluble solids. The WM-183 sludge sample had a volume of 2.33 mL and a mass of 2.91 g for a density of 1.25 g/cc. Allowing this sample to air dry resulted in a loss of 1.727 g. This loss has been attributed to water evaporation. The mass of air-dried sludge remaining was 1.179 g. The 1.727 g of water is equivalent to 1.727 mL of water. It follows that 1.727 mL of supernate were present in the 2.33-mL sludge sample (i.e., the volume fraction of the sludge is 75% water and the mass fraction is 59.5% water). Since the density of the supernate is 1.2 g/mL, 1.727 mL contains 0.35 g of soluble solids. This implies that 0.35 g/1.179 g or 30% of the total air-dried solids results from soluble solids deposited during evaporation of the sample. The importance of the air-dried samples is that water was removed by evaporation but the sample was otherwise unchanged (WSRC 2002).

No equivalent data exist for WM-182. Therefore, it was assumed that the WM-183 drying and density data were also applicable to the WM-182 sludge sample. The hydrogen ion concentrations for the samples are 0.53 M for WM-182 and 2.5 M for WM-183. The specific gravity values for the two samples are 1.1 g/mL for WM-182 and 1.2 g/mL for WM-183.

The density of air-dried solids (2 g/cc) does not directly relate to the density of residual solids in clean tanks. The relatively small particle size, the flocculent nature of the residual solids, and the higher pH of the liquids have an effect on the actual density of the solids compared to the density that has been measured in the pre-cleaning samples. When using the observation method to map the tank bottoms, the amount of solids observed is likely similar to the density of samples taken prior to cleaning or 1.2–1.4 g/cc not those of air-dried solids. That is, when examining the videotape, observed solids contain interstitial liquids between particles that occupy volume, and the volume of solids to the observer is greater than the actual volume.

D-1.1.1.2 Interstitial Liquids. The supernate, or interstitial liquids in solids, was not introduced in the calculation of mass in Section 2 of this document. The residual solids are composed of small particles that have a considerable percentage of interstitial liquids that occupy space between the particles. Due to multiple liquid additions during retrieval and cleaning, the liquids remaining in the tank, including interstitial liquids, are not the liquids that were directly produced during the reprocessing of spent nuclear fuel. Since the volume of interstitial liquids has been measured to be 75% by volume (EDF-015722-041, 2000; WSRC 2002), measurements of supernate in solid samples collected before cleaning were measured at 75%. If a value of 75% interstitial liquids was used in the calculation, it would have a significant reduction in estimated solid mass. If the Tank WM-182 inventory was used as an example, the 2,391 Ci in solids would be reduced to approximately 600 Ci. It is likely the interstitial liquids may be somewhat less than measured in residual solids prior to cleaning, but it is apparent based on particle size and observation of the settling rate that some volume of interstitial liquids remains in the cleaned tanks.

D-1.1.1.3 Solids Removal during Grout Placement. The effectiveness of radionuclide removal by the engineered grout placement also introduces uncertainty of the radionuclide inventory. It is not known how much of the residual solids will be removed; based on the mockup some portion is removed, but a method to quantify the removal was not used. The initial amount of residual solids remaining in each tank and the distribution of residual solids on the bottom will affect the removal achieved by the engineered grout placements. For instance, Tank WM-182 may have a greater total Ci removal than a tank like WM-186, which has a smaller starting inventory.

D-1.1.1.4 Solids Mass Estimates. Conservative estimates of the properties of the residual solids were made. Visual examination and Kriging methods were used to estimate the volume of solids. Each estimate was made to bias high the volume of solids during the examination. While errors are likely, there is not a reasonable way to quantify the uncertainty associated with visual estimation of solids height remaining in the tanks.

D-1.1.1.5 Limited Number of Solid Samples. The limited number of samples and analytical results introduces uncertainty into the inventory. The total activity could increase in Tank WM-182, perhaps by as much as 1,600 Ci (over the Tank WM-182 estimate) based on the average 137Cs concentration detected in Tanks WM-182, WM-183, and WM-188 prior to cleaning. While this is a significant increase in radioactivity, the effect on radioactive waste concentration would not be significant because most of the increase would be due to 137Cs and its daughter 137Ba. These increases of short-lived radionuclides are not significant when a 100-fold increase would be necessary to approach the sum of the fractions calculated for long-lived radionuclides.

D-1.1.1.6 Conclusions. If the data from the 2005 sampling of Tank WM-183 are used in the calculation, the sum of the fractions is 0.73. This value is slightly higher than the base case due to a slight increase in the concentration of ^{239}Pu in the sample concentration detected after the initial cleaning in Tank WM-183. When the 95% UCL around the mean is used from any sample taken either before or after cleaning, the sum of the fractions equals 0.84 due the concentration of ^{238}Pu in Tank WM-182 prior to cleaning. When the lowest concentrations from the 2003 or 2005 sampling events are used, the sum of the fractions is 0.43. The lowest concentrations of all samples collected produce a sum of the fractions of 0.29 due to the lower concentrations of ^{238}Pu and ^{239}Pu in Tank WM-188 (pre-cleaning). Tables showing the sum of the fractions calculations are included in Appendix F.

The sum of the fractions of the example inventories described above demonstrates that the inventory of radionuclides as it pertains to waste concentration limits can be described by the various inventory estimates. Table D-2 shows the sum of the fractions using the various inventory estimates.

If alternative assumptions of volume of grout, density of solids, and 2005 sampling are used, the effect on the sum of the fractions provides more insight into the inventory and the concentration of radioactive waste. Using the measured density of 1.2 g/cc (INEEL 1999) for the residual solids lowers all calculated sum of the fractions by 14%.

Table D-2. Sum of the fractions for alternate inventories and densities of Tank WM-182.

Inventory Description	Sum of the Fractions		
	Density of 1.4 g/cc	Density of 1.2 g/cc	Density of 2 g/cc and Interstitial Liquids of 75%
95% UCL of all samples	0.84	0.72	0.30
Highest of 2003 and 2005 samples (Tank WM-183)	0.76	0.66	0.27
2005 WM-183 samples	0.73	0.63	0.26
Base case inventory	0.71	0.61	0.25
Lowest of 2003 and 2005 samples	0.43	0.37	0.15
Lowest of all samples	0.29	0.25	0.10

a. Interstitial liquids percentages are applicable to the air-dried density of 2 g/cc.

D-1.2 Variations in Grout Volume

For perspective in understanding the sensitivity of encapsulation grout pour volume, additional analysis is presented below.

D-1.2.1 Reduction of Encapsulation Grout Pour Volume

Use of the engineered grout placements and an encapsulation grout pour totaling 118 m^3 provides a basis for the 300,000-gal tank radioactive waste concentration calculations. This section evaluates the sensitivities of using less than the 118 m^3 in the encapsulation grout pour. The grout designed for the engineered grout placement has properties that enhance the removal of residuals from the tank. Because of the properties of each individual placement, the height of total placement during the mockups was approximately 4 ft. This represents the highest point of the pours as the various sections create an uneven surface with the lowest point being near the location of the steam jet used for removal of residuals. Figure D-3 shows the mounding and the uneven surface of the engineered grout placements.

The contaminated residual, which will be forced upward between pours and toward the steam jet, must be encapsulated. The uneven surface of the engineered grout placement must be covered with grout to encapsulate the remaining residual liquids and solids. The areas along the seams of each placement and the low point near the steam jet are likely locations for residuals to remain. Figures D-1 through -4 show the mixing between placements and the surrogate that has been forced to the surface of the grout. The encapsulation grout volume of 33 m^3 (118 m^3 total) is believed to be the minimum volume necessary to adequately encapsulate residuals exposed from the engineered grout placements. For analysis purposes, other volumes were evaluated as shown in Table D-3. The results of the sum of the fractions calculations are shown for a reduction of the entire grout volume to 100 m^3. This table also shows the sum of the fractions if the mass of tank steel up to a height of 3 ft (the tank bottom is also used) is used in the calculations. Table D-3 shows the results of using less encapsulating grout and using the inventory as described in Section 2 of this document.

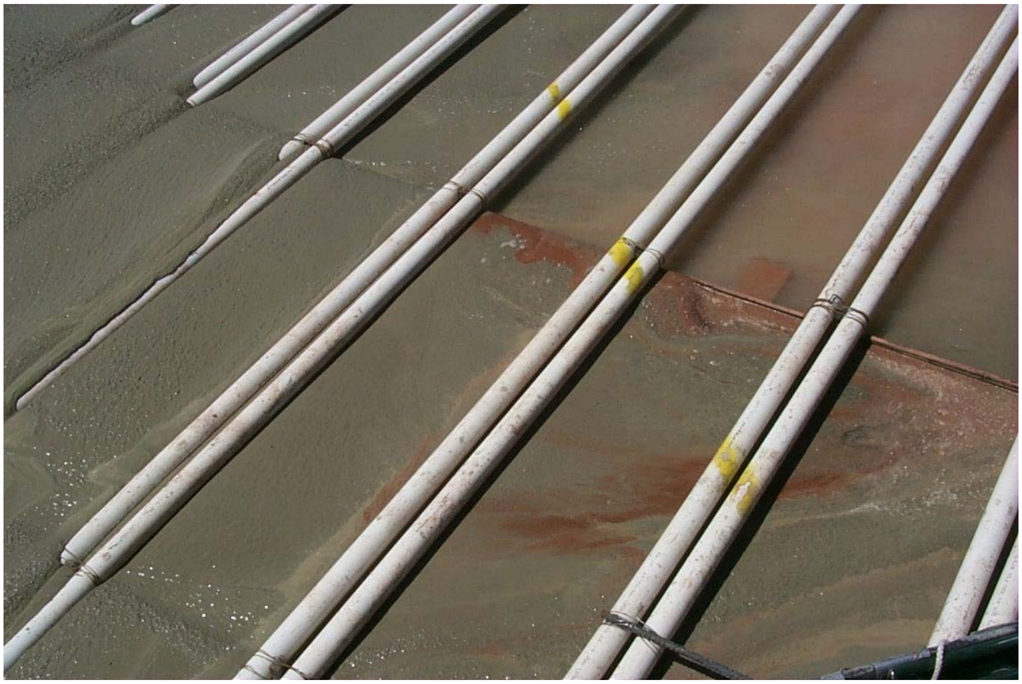

Figure D-1. Vertical mixing during mockup.

Figure D-2. Vertical mixing near the tank wall.

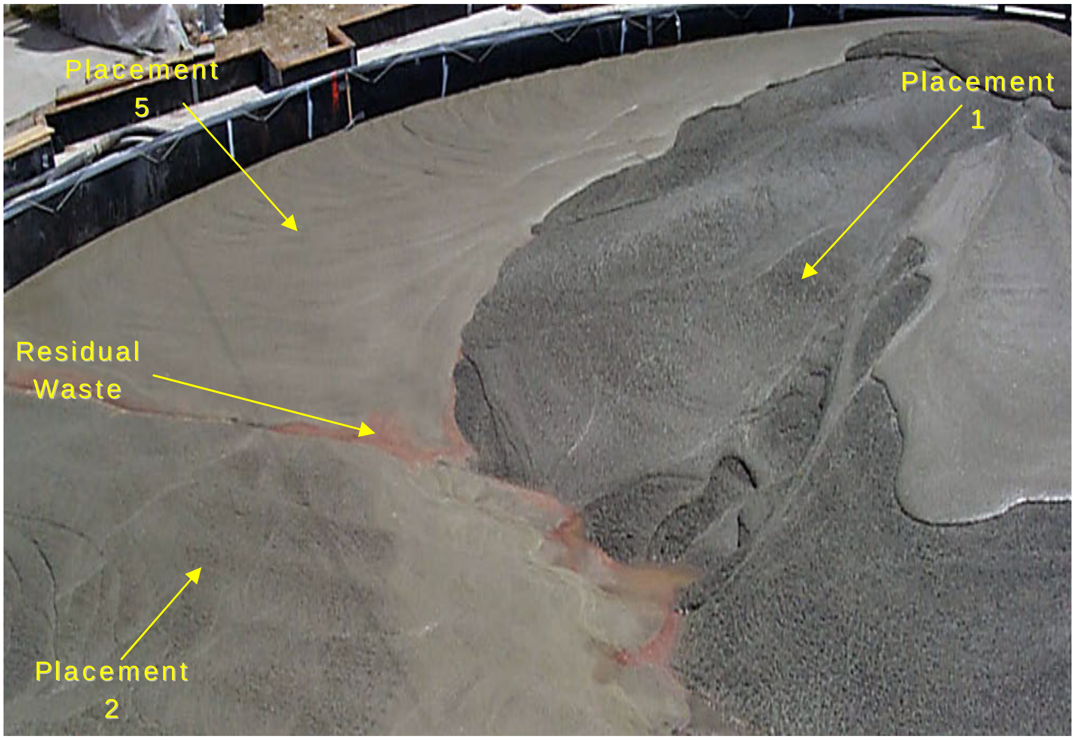

Figure D-3. Mounding of grout placements and vertical mixing.

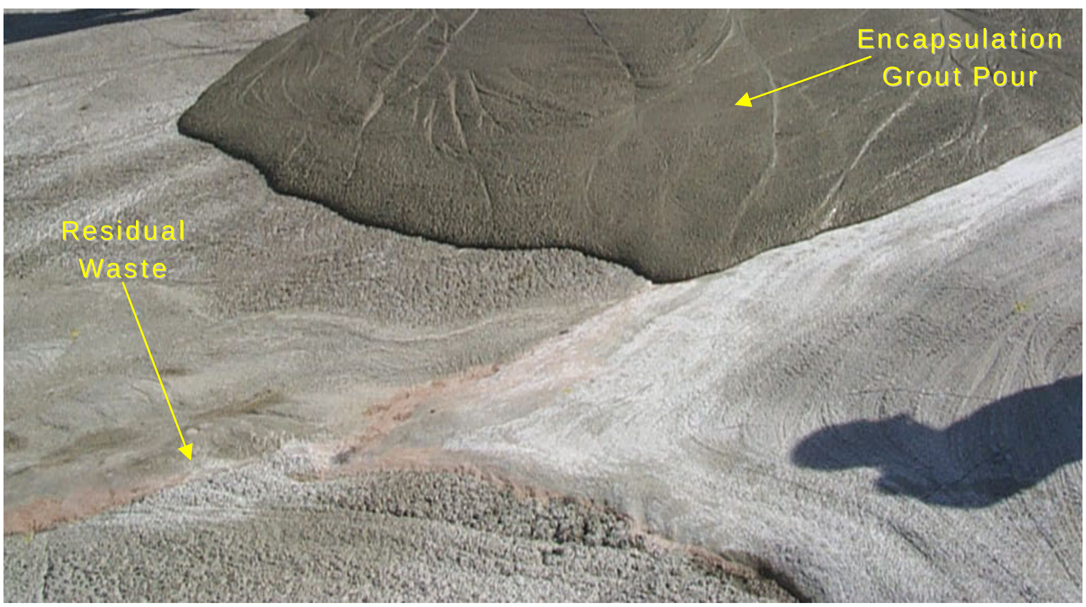

Figure D-4. Encapsulation grout pour covering surrogate that is on the surface.

Table D-3. Sum of the fractions for alternate volumes of grout.

Inventory Description	Density of 1.4 g/cc	Density of 1.2 g/cc
33 m^3 (118 m^3 total) [a]	0.65	0.56
33 m^3 (118 m^3 total)	0.71	0.61
15 m^3 (100 m^3 total)	0.83	0.71

a. These values show the results using the tank steel mass to a height of 3 ft and the tank bottom.

D-1.2.2 10:1 Ratio Unstabilized-to-Stabilized Material Encapsulation Pour

In addition to the set of principles discussed in the NRC's draft interim guidance, the guidance also includes statements that suggest *in most cases* the ratio of the unstabilized-to-stabilized radionuclide concentrations would not be significantly greater than a factor of 10 for comparison to Class C concentration limits. To address these statements, this section considers the feasibility of a grouting scenario, which would produce a "waste loading" approaching such a 10:1 ratio.

An encapsulation pour to simply fill the tanks with grout without using the engineered grout placements and the encapsulating grout sequence has been examined. This scenario assumes a 10-in.-deep grout pour (this 10-in.-deep grout pour would be appropriate to produce an approximate 10:1 ratio, with 1 in. of residual liquids in the tank and underlying tank solids). There are several factors that cause this type of grout pour to be unachievable in a large underground tank, including the inability to achieve a 10-in.-deep uniform grout pour where the grout meets minimum criteria. The currently planned pour also intends to remove additional residual material, which a 10-in.-deep pour would not achieve.

With only two available riser locations, a grout pour that is uniformly 10 in. deep across the tank bottom is not achievable. Grout that meets minimum criteria for strength, cracking, and bleed water is not self-leveling over a 50-ft-diameter tank. Grout will mound up in locations where it is placed and result in an uneven surface that may be 10 in. deep in some places but much greater than 10 in. deep in others. To achieve a grout pour near 10 in. of uniform depth, the grout must be very fluid. Adjusting the amount of water in the mixture is a simple method to obtain the desired fluidity. However, grout with additional water to increase fluidity will produce excessive cracking and bleed water. Additives are available to increase flow characteristics, but their effectiveness does not provide the flow characteristics for the grout to self-level in the tank. The grout must meet minimum criteria for low heat generation, low shrinkage, and limited cracking. A grout mixture that would meet the criteria described above would form mounds and, therefore, not meet a 10-in. uniform depth. Figures D-1 through -4 show the type of mounding of grout placements that will occur for currently planned TFF grout pours.

Use of a self-leveling pour in place of a sequenced engineered grout pour introduces many complications into the removal and encapsulation process. A single pour or a series of pours from two tank risers across the entire tank floor will plug the steam jet prematurely and allow liquids to remain in the tank that are not encapsulated in the grout. When the grout moves across the tank bottom, it will displace the residual liquids and put some of the fine solids in suspension. Some liquids and solids will be moved up the tank wall by the grout and deposited on top of the grout. Figure D-5 shows residual liquids and solids being forced up the tank wall. This is a photograph of an engineered grout placement, which allows liquids and suspended solids to flow along the tank wall to be removed by the steam jet. A non-engineered grout pour sequence would produce increased quantities of liquids and solids to be forced up the tank wall and onto the grout surface because the pour will not be sequenced to allow liquid to drain toward the steam jet. Figure D-6 shows that some residuals remain on the engineered grout placements, which require encapsulation by additional grout.

Tanks with cooling coils also provide complications for a simple encapsulation grout pour. The cooling coils tend to slow the flow of grout mixtures. Figure D-6 shows grout flow being restricted by cooling coils. The top of the cooling coils are approximately 7 in. above the tank bottom. The presence of these coils 3 in. from the surface may introduce cracking in a 10-in. grout pour scenario.

For the reasons discussed above, the limitations of a 10-in.-deep grout pour to self-level over a 50-ft-diameter tank create a scenario that would not adequately encapsulate residual waste under actual field conditions.

Figure D-5. Liquids and solids rise along the tank wall as grout is poured.

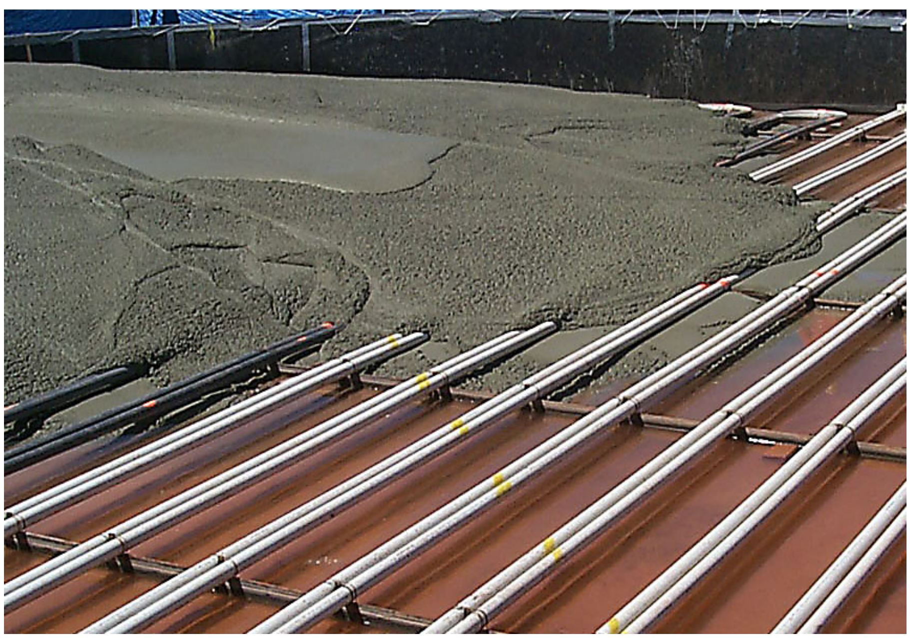

Figure D-6. Grout flow is hampered by cooling coils.

Although statements are made in the NRC draft interim guidance that suggest *in most cases* the ratio of the unstabilized-to-stabilized radionuclide concentrations would not be significantly greater than a factor of 10 for comparison to Class C concentration limits, for the reasons discussed above, it is not judged feasible to achieve a grouting scenario that achieves such a 10:1 ratio. However, for illustrative purposes, an analysis was performed using a 10:1 ratio of unstabilized-to-stabilized waste mass. Final waste form concentrations were calculated by assuming the original radioactivity in the tank achieves a 10% waste loading in the grout. Table D-4 shows that each of the cleaned 300,000-gal tanks would have concentrations of radionuclides above Class C concentration limits in Tables 1 and 2 of 10 CFR 61.55 even with depths of grout less than 1.3 in. However, while the NRC has stated in their draft interim guidance that it is appropriate *in general* to use such a 10:1 ratio as reference point, this evaluation concludes that, based upon analysis of actual site-specific conditions, operational constraints, and technical considerations, as discussed above, it is not appropriate or reasonable for calculating final waste concentrations at the TFF. The results shown in Table D-4 demonstrate that a ten-fold stabilization factor produces identical results in sum of the fractions calculations. Although each tank has differing amounts of residuals, and consequently, differing mass of added grout to achieve a 10:1 ratio, variations in the amount of estimated residual mass in each tank do not alter sum of the fractions values since tank cleaning activities do not reduce the concentration of relatively insoluble radionuclides in the tank solids. No amount of tank washing would result in reduced sum of the fractions values. Therefore, these calculations show that the mass of remaining tank solids is irrelevant to this type of simplified 10:1 analysis, and therefore, all of the 300,000-gal tanks would be calculated at greater than Class C concentration limits.

Table D-4. Sum of the fractions using 10:1 ratio of unstabilized-to-stabilized radionuclide concentrations.

	Tank WM-180	**Tank WM-181**	**Tank WM-182**	**Tank WM-183**	**Tank WM-184**	**Tank WM-185**	**Tank WM-186**
Volume of Grout (m^3)	2.6	1.2	5.9	3.3	2.7	3.4	1.6
Inches of Grout	0.6	0.3	1.3	0.7	0.6	0.7	0.3
Mass of Grout (kg)	5.00E+03	2.00E+03	1.00E+04	7.00E+03	6.00E+03	7.00E+03	3.00E+03
Radionuclide	**Fraction of Limit**	**Fraction of Limit**	**Fraction of Limit**	**Fraction of Limit**	**Fraction of Limit**	**Fraction of Limit**	**Fraction of Limit**
^{241}Am	3.40E–01	3.40E–01	3.40E–01	3.40E–01	3.40E–01	3.40E–01	3.40E–01
^{14}C	8.90E–03	8.90E–03	8.90E–03	8.90E–03	8.90E–03	8.90E–03	8.90E–03
^{242}Cm	5.30E–06	5.30E–06	5.30E–06	5.30E–06	5.30E–06	5.30E–06	5.30E–06
^{129}I	2.80E–03	2.80E–03	2.80E–03	2.80E–03	2.80E–03	2.80E–03	2.80E–03
^{59}Ni	6.00E–07	6.00E–07	6.00E–07	6.00E–07	6.00E–07	6.00E–07	6.00E–07
^{94}Nb	2.10E–02	2.10E–02	2.10E–02	2.10E–02	2.10E–02	2.10E–02	2.10E–02
^{237}Np	3.80E–02	3.80E–02	3.80E–02	3.80E–02	3.80E–02	3.80E–02	3.80E–02
^{238}Pu	9.20E+00	9.20E+00	9.20E+00	9.20E+00	9.20E+00	9.20E+00	9.20E+00
^{239}Pu	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00
^{240}Pu	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
^{241}Pu	4.50E–01	4.50E–01	4.50E–01	4.50E–01	4.50E–01	4.50E–01	4.50E–01
^{242}Pu	8.00E–04	8.00E–04	8.00E–04	8.00E–04	8.00E–04	8.00E–04	8.00E–04
^{99}Tc	5.60E–05	5.60E–05	5.60E–05	5.60E–05	5.60E–05	5.60E–05	5.60E–05
Sum of the Fractions	**14**	**14**	**14**	**14**	**14**	**14**	**14**

Table D-4. (continued).

	Tank WM-180	Tank WM-181	Tank WM-182	Tank WM-183	Tank WM-184	Tank WM-185	Tank WM-186

Notes:

* The volume/mass and radionuclide concentrations for the residual solids were taken from PEI-EDF-1009, 2005; PEI-EDF-1010, 2005; PEI-EDF-1011, 2005; PEI-EDF-1012, 2005; PEI-EDF-1013, 2005; PEI-EDF-1015, 2005; PEI-EDF-1016, 2006; PEI-EDF-1018, 2006; PEI-EDF-1019, 2005.

* The residual volume/mass estimate in each tank was based only on the remaining solids, without including the volume of remaining liquids. The volume of the remaining liquids was not used because it contained insignificant concentrations of radionuclides.

* The individual grout volume/mass was calculated to produce a 10% waste loading.

* The resulting radionuclide concentrations were compared to values in Table 1 of 10 CFR 61.55.

* The sum of the fractions is identical for these tanks because the inventory concentrations are from the same data set as described in Section D-1.1.

D-1.2.3 Concentration of Radionuclides in Drill Cuttings

Past guidance for determining concentrations for comparison with Class C concentration limits of 10 CFR 61.55 was based on excavation as the likely pathway to expose an inadvertent member of the public as a result of waste in a commercial burial site. This pathway is not applicable to tanks and their associated waste. The stabilized tank residual waste is much deeper in the ground, and is protected by both a thick surface barrier and a massive grout-filled tank structure, which makes the basement excavation scenario an impractical scenario. A more credible scenario is one in which the inadvertent intruder is drilling a well for groundwater and drills through the tank. During this drilling process the residual waste encountered by the drill is mixed with the other drill cuttings and brought to the surface where the driller and future site users can be exposed to the radioactive waste. Only the volume of tank grout from the drill cutting is used for the sum of the fractions calculations.

The inadvertent intruder places his drill rig on top of the tank surface barrier and drills into the tank using a typical domestic water well diameter drill. The driller drills through the waste heel at its highest point and abandons the hole when the drill reaches the bottom of the tank (worst case). Because of the way the drill cuttings are brought to the surface (by air or water), the residual waste encountered by the drill is mixed with all the other material the drill encounters as it penetrates the tank. The concentration of radionuclides is calculated by averaging the residual waste in the drill hole with the grout column that extends from the top to the bottom of the tank, which is approximately 10 m. To ensure conservatism in the estimate, the mass of the vault type, any overburden, and volume of a closure cap are not included in the calculation. The sum of the fractions is shown in Tables D-5 and -6. Table D-5 shows the results of drilling to the bottom of the tank. Table D-6 shows the results of drilling through the tank and into the contaminated sandpad.

The following data or assumptions were used in the Table D-5 tank calculations:

1. The diameter of the drill is 8 in.

2. The maximum height of waste is 1.22 cm

3. The volume of residual waste is 3.95E–04 m^3

4. The mass of residual waste is 0.83 kg

5. The volume of grout in the borehole is 1.166 m^3.

Table D-5. Sum of the fractions using an intruder scenario—drilling to bottom of tank.

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Ci/m^3	nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Limit
^{241}Am	432.2	2.80E–04		1.15E–01	1.00E+02	1.15E–03
^{14}C	*5,730*	3.30E–09	*2.82E–09*		*8.00E+00*	*3.52E–10*
^{242}Cm	0.446	8.80E–07		3.61E–04	2.00E+04	1.80E–08
^{129}I	*15,700,000*	5.20E–07	*4.44E–07*		*8.00E–02*	*5.55E–06*
^{59}Ni	*75,000*	1.70E–05	*1.44E–05*		*2.20E+02*	*6.56E–08*
^{94}Nb	*20,300*	1.40E–04	*1.18E–04*		*2.00E–01*	*5.91E–04*
^{237}Np	2,140,000	3.20E–05		1.29E–02	1.00E+02	1.29E–04
^{237}Pu	87.75	7.70E–03		3.13E+00	1.00E+02	3.13E–02
^{239}Pu	24,131	2.30E–03		9.33E–01	1.00E+02	9.33E–03
^{240}Pu	6,970	9.10E–04		3.70E–01	1.00E+02	3.70E–03
^{241}Pu	14.4	1.30E–02		5.34E+00	3.50E+03	1.53E–03
^{242}Pu	375,800	6.60E–07		2.70E–04	1.00E+02	2.70E–06
^{99}Tc	*213,000*	5.10E–04	*4.39E–04*		*3.00E+00*	*1.46E–04*
Sum of the Fractions						**0.05**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3 ; remaining nuclides are compared to limits in units of nCi/g.
b. Radioactive decay to 2012.

The following data or assumptions were used in the tank and sandpad calculations in Table D-6:

1. The diameter of the drill is 8 in.
2. The maximum height of waste is 15.24 cm
3. The volume of residual waste is 2.78E–03 m^3
4. The mass of residual waste is 4.86 kg
5. The volume of grout in the borehole is 1.166 m^3
6. The volume of the sandpad is 23.6 m^3.

Table D-6. Sum of the fractions using an intruder scenario—drilling to bottom of sandpad.

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Ci/m^3	nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Limit
^{241}Am	432.2	3.80E–04		2.75E–01	1.00E+02	2.75E–03
^{14}C	*5,730*	1.90E–09	*2.88E–09*		*8.00E+00*	*3.60E–10*
^{242}Cm	0.446	4.99E–07		3.60E–04	2.00E+04	1.80E–08
^{129}I	*15,700,000*	2.92E–07	*4.43E–07*		*8.00E–02*	*5.53E–06*
^{59}Ni	*75,000*	1.22E–05	*1.85E–05*		*2.00E–01*	*9.23E–05*
^{94}Nb	*20,300*	7.76E–05	*2.88E–09*	5.61E–02	1.00E+02	5.61E–04
^{237}Np	2,140,000	2.60E–04		1.88E–01	1.00E+02	2.00E–03
^{237}Pu	87.75	4.50E–03		3.25E+00	1.00E+02	3.25E–02
^{239}Pu	24,131	1.33E–03		9.58E–01	1.00E+02	9.58E–03
^{240}Pu	6,970	7.77E–04		5.62E–01	3.50E+03	1.60E–04
^{241}Pu	14.4	7.36E–03		5.32E+00	1.00E+02	5.32E–02
^{242}Pu	375,800	3.73E–07		2.75E–01	*3.00E+00*	*1.88E–07*
^{99}Tc	*213,000*	3.80E–04	*5.65E–07*		1.00E+02	2.75E–03
Sum of the Fractions						**0.10**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3 ; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012.

D-2. ADDITIONAL SENSITIVITY EVALUATION: TANK AND VAULT VIEWED AS A SINGLE UNIT FOR COMPARISON TO CLASS C CONCENTRATION LIMITS

To aid in understanding the sensitivity of waste form calculations shown above, a tank and vault is shown as a single unit for comparison to Class C concentration limits in this section. A combination of the most contaminated tank and most contaminated sandpad will be used to establish a worst case. Tank WM-185 and its vault contain the greatest amount of residual waste of the cleaned tanks and vaults. Tank WM-185 contains an estimated mass of residual waste of 720 kg (1,391 Ci of residuals) and Tank WM-182 has an estimated mass of residual of 1,238 kg (2,394 Ci of residuals). The contaminated sandpad contains 3,850 Ci of residual waste. Therefore, Tank WM-185 and the sandpad have a total Ci inventory of 5,241 Ci, and Tank WM-182 and a contaminated sandpad would have an inventory of 6,244-Ci. Two scenarios are presented for waste concentrations for the tank and vault system. The first scenario uses Tank WM-185 tank residuals and the contaminated sandpad. As a second sensitivity evaluation, the Tank WM-182 residual waste and a contaminated sandpad (Tank WM-185 sandpad) will be examined.

Tanks WM-185 and WM-187 have contaminated sandpads. Only Tank WM-185 has been cleaned to date. The highest radionuclide inventory of cleaned tanks and vaults is from the contaminated sandpad and Tank WM-185. Therefore, it is reasonable to use this tank and vault for radioactive waste concentration calculations. Data for Tank WM-187 will be reviewed when the tank and vault are cleaned.

The tank and vault system are evaluated together because they are not independent entities. The tank lies within the vault and is separated from the vault contamination by only the tank wall and floor. The closed system will be a grouted monolith separate from other tanks and vaults. The basis of 10 CFR 61.55 Class C concentration limits is the inadvertent intruder scenario (70 FR 74846). The tank system approach is justified because the concentrations would be expected to approach homogeneity with respect to the intruder scenarios, and an important justification for the Class C concentration limits is to provide protection to the inadvertent intruder.

The tank system, which includes the tank and vault grouted monolith, would appear indistinguishable to the inadvertent intruder. The limiting intruder scenario for the TFF is the well-drilling scenario. An inadvertent intruder in the INL Site will drill a well with equipment that would penetrate basalt (basalt flows compose the majority of the subsurface at the INL Site). If the intruder would drill through a reinforced-concrete ceiling, grout above the tank dome, the stainless steel tank dome, and over 30 ft of grout, it is reasonable to assume that drilling would continue through the stainless steel tank bottom to enter the vault area.

As specified below in Section D-2.1, assumptions for calculation of the radioactive waste concentration of the tank system will include the tank walls and tank bottom, vault walls, and a portion of the tank system base mat. In addition, the volume and mass of grout for the engineered grout placements and encapsulation grout pours will be incorporated into the calculation.

Using the vault walls and a portion of the base mat are appropriate for the tank system waste concentration calculations. Also, as described in Section II of the draft interim guidance, the vaults are not defined as separate entities, but the tank and ancillary equipment are defined as one system. As stated in the draft interim guidance (70 FR 74846):

> *The guidance is not intended to address all unique situations at DOE sites. However, the guidance contained herein is generally applicable to the following scenarios:*
>
> *Underground waste storage tanks including heels, cooling coils, and residuals adhering to walls and other surfaces,*
>
> *Infrastructure used to support underground waste storage tanks such as transfer lines, transfer pumps, and diversion boxes.*

Use of the volume or mass of steel and/or vault material in calculation of the sum of the fractions is appropriate. The tank steel and the vault concrete are both contaminated to a certain degree and are considered to be LLW. The materials would be considered LLW if they were removed from the TFF and are considered LLW when kept in place.

D-2.1 Calculations for WM-185 Tank and Vault

The waste concentration calculations for the tank system are performed using Table 1 of 10 CFR 61.55. As with the individual components, the long-lived radionuclides are most important to waste concentration calculations. Table D-7 shows the sum of the fractions for the tank system using the WM-185 tank and vault.

The data or assumptions for the tank system are listed below.

1. The vault walls (including pillars and panels) are used in the calculations. The height of the pillars and panels used in the calculations is 4.5 ft.

2. 6 in. of the top of the base mat are included.

3. The density of reinforced concrete in the base mat and vault walls is 2.56 g/cc.

4. 118 and 32.5 m^3 of grout are placed in the tank and vault, respectively.

5. The mass of grout and steel is 6.06E+08 g.

6. The sandpad volume of 23.6 m^3 and the volume of the cone (8 m^3) of concrete underlying the sandpad are include in the calculation. The sandpad does not lie on a flat surface but rather a reinforced concrete cone, which is the diameter of the tank and 4 in. at the peak.

7. The volume of pillars and panels, sandpad, base mat, and cone equals 29.2, 23.6, 48, and 8 m^3, respectively. The total volume equals 261 m^3.

Table D-7. Sum of the fractions calculation for the tank system.

Radionuclide[a]	Half-Life (yr)	Tank System Inventory (Ci)[b]	Ci/m^3	nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Limit
^{241}Am	4.30E+02	2.10E+00		3.50E+00	100	0.0352
^{14}C	*5.70E+03*	*3.20E–06*	*1.20E–08*		*8*	*0.0000000016*
^{242}Cm	4.50E–01	9.40E–04		1.60E–03	20,000	0.00000008
^{129}I	*1.60E+07*	*4.50E–04*	*1.70E–06*		*0.08*	*0.000022*
^{59}Ni	*7.50E+04*	*1.20E–20*	*4.60E–23*		*220*	*0.00000000*
^{94}Nb	*2.00E+04*	*1.40E–01*	*5.50E–04*		*0.2*	*0.0027*
^{237}Np	2.10E+06	2.80E–02		4.60E–02	100	0.00046
^{238}Pu	8.80E+01	8.70E+00		1.40E+01	100	0.14
^{239}Pu	2.40E+04	3.60E+00		5.90E+00	100	0.059
^{240}Pu	7.00E+03	1.10E+00		1.90E+00	100	0.019
^{241}Pu	1.40E+01	1.40E+01		2.20E+01	3,500	0.006
^{242}Pu	3.80E+05	6.30E–04		1.00E–03	100	0.000010
^{99}Tc	*2.10E+05*	*4.40E–01*	*1.70E–03*		*3*	*0.0006*
Sum of the Fractions						**0.27**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3 ; remaining nuclides are compared to limits in units of nCi/g.
b. Radioactive decay to 2012.

An alternative scenario, which includes 2.5 ft of the vault walls (2 ft of the tank), a smaller amount of grout in the tank and vaults, and half of the base mat used in the previous calculation (3 in.), yields the sum of the fractions of 0.48 as shown in Table D-8. The total mass of this system is 3.51E+08 g.

The data or assumptions for the tank system alternative are listed below.

1. The vault walls (including pillars and panels) are used in the calculations. The height of the pillars and panels used in the calculations is 2.25 ft.

2. 3 in. of the top of the base mat are included.

3. The density of reinforced concrete in the base mat, pillars, and panels is 2.56 g/cc.

4. 46 and 32.5 m^3 of grout are placed in the tank and vault, respectively.

5. The mass of grout and steel is 3.34E+08 g.

6. The volume of pillars and panels, sandpad, base mat, and cone equal 14.5, 23.6, 24, and 8 m^3, respectively. Total volume equals 150 m^3.

Table D-8. Sum of the fractions calculations for minimum quantities of uncontaminated materials and encapsulating grout.

Radionuclide[a]	Half-Life (yr)	Tank System Inventory (Ci)[b]	Tank System Inventory Ci/m^3	nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Limit
^{241}Am	4.30E+02	2.10E+00		6.40E+00	100	0.0638
^{14}C	*5.70E+03*	*3.20E–06*	*2.20E–08*		*8*	*0.0000000027*
^{242}Cm	4.50E–01	1.40E–05		4.10E–05	20,000	0.00000000
^{129}I	*1.60E+07*	*4.50E–04*	*3.00E–06*		*0.08*	*0.000038*
^{59}Ni	*7.50E+04*	*1.20E–20*	*8.10E–23*		*220*	*0.00000000*
^{94}Nb	*2.00E+04*	*1.40E–01*	*9.50E–04*		*0.2*	*0.0048*
^{237}Np	2.10E+06	2.80E–02		8.30E–02	100	0.00083
^{238}Pu	8.80E+01	8.70E+00		2.60E+01	100	0.26
^{239}Pu	2.40E+04	3.60E+00		1.10E+01	100	0.106
^{240}Pu	7.00E+03	1.10E+00		3.40E+00	100	0.034
^{241}Pu	1.40E+01	1.40E+01		4.10E+01	3,500	0.012
^{242}Pu	3.80E+05	6.30E–04		1.90E–03	100	0.000019
^{99}Tc	*2.10E+05*	*4.40E–01*	*3.00E–03*		*3*	*0.0010*
Sum of the Fractions						**0.48**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3 ; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012.

D-2.2 Calculations for WM-182 Tank and Vault

The inventory for the tank system using the Tank WM-182 inventory and a contaminated sandpad has also been calculated. Tank WM-182 has the highest radionuclide inventory but its tank vault does not contain a contaminated sandpad. Using the inventory of a contaminated sandpad and highest inventory for a tank provides a bounding scenario for waste concentration calculations.

The method of using a sandpad inventory and the highest tank inventory was used in the PA and earlier in this document for intruder scenarios. Using this approach for the sum of the fractions calculations provides additional insight. The conditions of this scenario do not presently exist at the TFF. The only possible circumstance where this scenario could occur is if Tank WM-187, when cleaned, contains a similar inventory as Tank WM-182. Tank WM-187 may contain the same inventory or greater than WM-182, but the inventory for the WM-187 sandpad is half of the inventory for WM-185. Tables D-9 and -10 show the sum of the fractions calculations for this scenario using the same data or assumptions shown in Tables D-7 and -8.

Table D-9. Sum of the fractions calculations for tank system using bounding inventory.

Radionuclide[a]	Half-Life (yr)	Tank System Inventory (Ci)[b]	Ci/m^3	nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Limit
^{241}Am	4.30E+02	2.30E+00		3.80E+00	100	0.0381
^{14}C	*5.70E+03*	*5.30E–06*	*2.00E–08*		*8*	*0.0000000026*
^{242}Cm	4.50E–01	1.30E–03		2.20E–03	20,000	0.00000011
^{129}I	*1.60E+07*	*7.70E–04*	*3.00E–06*		*0.08*	*0.000037*
^{59}Ni	*7.50E+04*	*2.50E–02*	*9.60E–05*		*220*	*0.00000044*
^{94}Nb	*2.00E+04*	*2.30E–01*	*8.80E–04*		*0.2*	*0.0044*
^{237}Np	2.10E+06	4.70E–02		7.80E–02	100	0.00078
^{238}Pu	8.80E+01	1.30E+01		2.20E+01	100	0.22
^{239}Pu	2.40E+04	5.00E+00		8.20E+00	100	0.082
^{240}Pu	7.00E+03	1.70E+00		2.80E+00	100	0.028
^{241}Pu	1.40E+01	2.20E+01		3.60E+01	3,500	0.010
^{242}Pu	3.80E+05	1.00E–03		1.70E–03	100	0.000017
^{99}Tc	*2.10E+05*	*7.60E–01*	*2.90E–03*		*3*	*0.0010*
Sum of the Fractions						**0.39**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3 ; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012.

Table D-10. Sum of the fractions calculations for minimum quantities of uncontaminated materials and encapsulating grout and bounding inventory.

Radionuclide[a]	Half-Life (yr)	Tank System Inventory (Ci)[b]	Ci/m^3	nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Limit
^{241}Am	4.30E+02	2.30E+00		6.60E+00	100	0.0658
^{14}C	*5.70E+03*	*5.30E–06*	*3.60E–08*		*8*	*0.0000000045*
^{242}Cm	4.50E–01	1.40E–05		3.90E–05	20,000	0.00000000
^{129}I	*1.60E+07*	*7.70E–04*	*5.20E–06*		*0.08*	*0.000065*
^{59}Ni	*7.50E+04*	*1.20E–20*	*8.00E–23*		*220*	*0.00000000*
^{94}Nb	*2.00E+04*	*2.30E–01*	*1.50E–03*		*0.2*	*0.0076*
^{237}Np	2.10E+06	4.70E–02		1.40E–01	100	0.00135
^{238}Pu	8.80E+01	1.30E+01		3.80E+01	100	0.38
^{239}Pu	2.40E+04	5.00E+00		1.40E+01	100	0.142
^{240}Pu	7.00E+03	1.70E+00		4.90E+00	100	0.049
^{241}Pu	1.40E+01	2.20E+01		6.20E+01	3,500	0.018
^{242}Pu	3.80E+05	1.00E–03		3.00E–03	100	0.000030
^{99}Tc	*2.10E+05*	*7.60E–01*	*5.1E–03*		*3*	*0.0017*
Sum of the Fractions						**0.67**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012.

D-2.3 Summary and Conclusions

Under this sensitivity evaluation, at closure and disposal, the radioactive waste concentration for the 300,000-gal tank and vault system would be below Class C concentration limits. The basis for this is the intruder analysis in the PA (DOE-ID 2003), intruder calculations earlier in this document, and the completion of waste concentration tables as described in 10 CFR 61.55. The tank system, which includes the tank and vault grouted monolith, would appear indistinguishable to the inadvertent intruder. The various calculations performed and operational constraints described provide reasonable scenarios to be presented for comparison to Class C concentration limits.

Using inventory from Tank WM-182 provides assurance that the tank system inventory is estimated conservatively. Tank WM-187 remains to be cleaned. Assuming the tank with the highest inventory and a sandpad provides a reasonable worst-case estimation of the Tank WM-187 system. The tank system calculations, using a minimum of grout and uncontaminated materials, also provide assurance that the radionuclide concentration is reasonable.

D-3. REFERENCES

10 CFR 61, 2004, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, Office of the Federal Register, January 1, 2004.

70 FR 74846, Notice: "Draft Interim Concentration Averaging Guidance for Waste Determinations," Federal Register, U.S. Nuclear Regulatory Commission, December 16, 2005, pp. 74846–74850.

DOE-ID, 2003, *Performance Assessment for the Tank Farm Facility at the Idaho National Engineering and Environmental Laboratory,* DOE/ID-10966, Rev. 1, April 2003 (Errata December 2, 2003).

EDF-TST-001, 2000, "Solids Characterization," September 20, 2000.

EPA, 2006a, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, EPA/240/B-06/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington D.C., February 2006.

EPA, 2006b, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C., February 2006.

GDE-205, 2004, "Radioanalytical Data Validation," Environmental Services, Rev. 1, May 11, 2004.

ICP, 2006, *Response to Request for Additional Information on the Draft Section 3116 Determination Idaho Nuclear Technology and Engineering Center Tank Farm Facility*, ICP/EXT-06-01204, May 31, 2006.

INEEL, 1999, *Idaho Nuclear Technology and Engineering Center Tank Farm Facility (TFF) Closure TFF WM-182 Grout Mock-Up*, INEEL/EXT-99-01067, Rev. 0, October 1999.

NRC, 1982, *Final Environmental Impact Statement on 10 CFR 61 "Licensing Requirements for Land Disposal of Radioactive Waste"*, NUREG-0945, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, November 1982.

WSRC, 2002, "Development of an Initial Simulant for the Idaho Tank Farm Solids," WSRC-TR-2002-00436, Westinghouse Savannah River Company, Savannah River Technology Center Immobilization Technology Section, 2002.

Appendix E

Residual Waste Inventory and Grout Volume used in Final 300,000-gal Tank Concentration Calculations

Appendix E

Residual Waste Inventory and Grout Volume used in Final 300,000-gal Tank Concentration Calculations

E-1. ESTIMATE OF FINAL RESIDUAL WASTE INVENTORY AT CLOSURE

For purposes of determining radionuclide concentrations, the inventory for Tank WM-182 (shown in Table E-1) is used because this tank contains the largest amount of residual radioactivity of the cleaned tanks. The residual waste inventory at closure and disposal is based on an assumption that at least the same degree of radionuclide removal will be achieved in the tanks remaining to be cleaned. The residual waste inventory at closure and disposal is approximately 2,394 Ci in Tank WM-182, of which approximately 3 Ci remain in liquid. The mass of solid residual is estimated to be 1,238 kg. The volume of liquid (1-in. depth) estimated to be remaining is approximately 5,000 L.

Videos and photographs of the tank walls show staining and discoloration, but no discernible buildup of residual waste. Therefore, no inventory for the tank walls was included in the tank inventory as discussed in Section 2 of this document. The residual waste for determination of concentrations includes the residual liquids and solids located at the bottom of the tank.

Table E-1. Residual waste inventory at closure and disposal for Tank WM-182.

Radionuclide	Residual Liquids (Ci)	Residual Solids (Ci)	Total Residuals (Ci)
^{241}Am	5.30E–04	5.43E+00	5.43E+00
^{137m}Ba	1.11E+00	1.14E+03	1.14E+03
^{242}Cm	6.58E–07	1.32E–03	1.32E–03
^{137}Cs	1.11E+00	1.14E+03	1.14E+03
^{14}C	5.39E–08	4.90E–06	4.96E–06
^{129}I	1.12E–06	7.73E–04	7.74E–04
^{3}H	1.66E–05	7.17E–01	7.17E–01
^{94}Nb	4.03E–05	2.06E–01	2.06E–01
^{59}Ni	1.25E–05	2.51E–02	2.51E–02
^{63}Ni	1.43E–03	2.86E+00	2.86E+00
^{237}Np	2.71E–07	4.70E–02	4.70E–02
^{238}Pu	2.47E–03	1.14E+01	1.14E+01
^{239}Pu	2.44E–04	3.40E+00	3.40E+00
^{240}Pu	6.74E–04	1.35E+00	1.35E+00
^{241}Pu	5.89E–04	1.95E+01	1.95E+01
^{242}Pu	4.93E–07	9.87E–04	9.88E–04
^{90}Sr	2.41E–01	2.32E+01	2.34E+01
^{99}Tc	4.54E–05	7.64E–01	7.64E–01
^{90}Y	2.41E–01	2.32E+01	2.34E+01
Total Ci (all radionuclides)	3	2,391	2,394

E-2. VOLUME OR MASS OF THE FINAL WASTE FORM

The grout added after the engineered grout placement is expected to stabilize the remaining residual waste by capping the engineered grout placements and the residual waste on the surface. The engineered grout placements and residual waste comprise 85 m^3 of material. A pour of 140 m^3 is planned to cover the engineered grout placements and ensure any remaining residuals are adequately stabilized. Visual inspection from the 1999 mockup indicates some unquantifiable volume of residual contamination that is not mixed with the engineered grout remains on top of the placements (INEEL 1999). This material will be stabilized using the encapsulation grout pour. For purposes of final waste form concentration calculations, as explained below, only a fraction of the 140 m^3 has been assumed to be necessary to stabilize the residuals remaining after the engineered grout placements.

A review of the full-scale mockup photographs allowed calculation of a minimum volume necessary to encapsulate the residual waste on top of the engineered grout placements.

The first two engineered grout placements create very high mounds. The remaining three placements do not create high mounds and the area of residuals is widely distributed on the surface. Approximately three-fifths of the tank area requires some amount of grout to encapsulate the residual waste. The first two engineered grout placements create mounds that occupy approximately two-fifths of the area of the tank. The remaining three-fifths of the tank contain some amount of waste residual (solid or liquid). The area near the steam jet is the low point of the engineered grout placements and requires over 2 ft of grout to stabilize the liquids and solids remaining. Therefore, an estimate of three-fifths of the tank area at an average depth of 1 ft is required to stabilize the residual waste on the surface of the engineered grout placements. This results in a volume of 33 m^3 of grout.

The engineered grout placement has a volume of 85 m^3. Because of the enhanced waste mixing and the important residual waste removal function, a reduction of this volume of the engineered grout placement is not practical.

Therefore, in the final waste form calculations, the volume of grout used is comprised of 85 m^3 in the engineered grout placements, plus 33 m^3 of grout in the encapsulation pour, for a total grout volume of 118 m^3. This is equivalent to a level pour of approximately 2 ft of grout.

E-3. REFERENCES

INEEL, 1999, *Idaho Nuclear Technology and Engineering Center Tank Farm Facility (TFF) Closure TFF WM-182 Grout Mock-Up*, INEEL/EXT-99-01067, Rev. 0, October 1999.

Appendix F

Tables for Sum of the Fractions Calculations Discussed in Sensitivity Evaluations

Appendix F

Tables for Sum of the Fractions Calculations Discussed in Sensitivity Evaluations

The tables in this appendix show various calculations of the sum of the fractions using inventories prepared with sample data that have been collected directly from the Tank Farm Facility (TFF) tanks. Until 1999, any solid samples associated with tanks were collected after a liquids transfer to a collection tank at the Waste Calcining Facility or the New Waste Calcining Facility. These samples include Tanks WM-188, WM-183, and WM-182. Samples were collected before cleaning was started and two samples from WM-183 were collected after cleaning was complete.

Table F-1 shows the tank inventory and the sum of the fractions for long-lived radionuclides using data collected from Tank WM-183 in 2005. This table and the others in this appendix use the WM-182 tank mass and inventory for radionuclides. Tank WM-182 is used because it had the greatest inventory of all the cleaned tanks. This sample was collected after the tanks were cleaned, after a valve was not closed completely, and approximately 200 gal of sodium-bearing waste entered the tank. Solid and liquid samples were collected from the second tank cleaning. It is assumed the redistribution of residual solids allowed the solids sample to be collected. Tables F-1 through F-5 use a volume of grout of 118 m^3 and no tank steel.

Table F-1. Calculation of the sum of the fractions using 2005 data from Tank WM-183.

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Tank Inventory Ci/m^3	Tank Inventory nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Class C Concentration Limit
^{241}Am	4.30E+02	4.10E–01		1.70E+00	100	0.0167
^{14}C	*5.70E+03*	*2.70E–02*	*2.30E–04*		*8*	*0.0000281965*
^{242}Cm	4.50E–01	1.30E–03		5.30E–03	20,000	0.00000027
^{129}I	*1.60E+07*	*1.00E–03*	*8.90E–06*		*0.08*	*0.000111*
^{59}Ni	*7.50E+04*	*2.50E–02*	*2.10E–04*		*220*	*0.00000097*
^{94}Nb	*2.00E+04*	*2.50E–02*	*2.10E–04*		*0.2*	*0.0011*
^{237}Np	2.10E+06	4.20E–01		1.70E+00	100	0.01676
^{238}Pu	8.80E+01	1.10E+01		4.60E+01	100	0.46
^{239}Pu	2.40E+04	3.90E+00		1.60E+01	100	0.158
^{240}Pu	7.00E+03	1.40E+00		5.50E+00	100	0.055
^{241}Pu	1.40E+01	1.90E+01		7.90E+01	3,500	0.022
^{242}Pu	3.80E+05	9.90E–04		4.00E–03	100	0.000040
^{99}Tc	*2.10E+05*	*1.40E–01*	*1.20E–03*		*3*	*0.0004*
Sum of the Fractions						**0.73**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-2 shows the calculation of sum of the fractions for long-lived radionuclides (Tank WM-182 inventory) using the highest concentration from either of the Tank WM-183 post-cleaning samples. If only one of the sampling events had a detection for a radionuclide, that sample was used in the calculation.

Table F-2. Calculation of the sum of the fractions using Tank WM-183 post-cleaning data (highest concentration).

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Tank Inventory Ci/m^3	Tank Inventory nCi/g	Class C Concentration Limit (Ci/m^3 or nCi/g)	Fraction of Class C Concentration Limit
^{241}Am	432.2	4.10E–01		1.66E+00	1.00E+02	1.66E–02
^{14}C	*5,730*	*4.96E–06*	*4.20E–08*		*8.00E+00*	*5.25E–09*
^{242}Cm	0.446	1.32E–03		5.32E–03	2.00E+04	2.66E–07
^{129}I	*15,700,000*	*7.74E–04*	*8.86E–06*		*8.00E–02*	*1.11E–04*
^{59}Ni	*75,000*	*2.51E–02*	*2.13E–04*		*2.20E+02*	*9.68E–07*
^{94}Nb	*20,300*	*2.06E–01*	*1.74E–03*		*2.00E–01*	*8.71E–03*
^{237}Np	2,140,000	1.25E–02		5.05E–02	1.00E+02	5.05E–04
^{238}Pu	87.75	1.24E+01		4.99E+01	1.00E+02	4.99E–01
^{239}Pu	24,131	3.92E+00		1.58E+01	1.00E+02	1.58E–01
^{240}Pu	6,970	1.35E+00		5.45E+00	1.00E+02	5.45E–02
^{241}Pu	14.4	1.95E+01		7.87E+01	3.50E+03	2.25E–02
^{242}Pu	375,800	9.88E–04		3.99E–03	1.00E+02	3.99E–05
^{99}Tc	*213,000*	*7.64E–01*	*6.47E–03*		*3.00E+00*	*2.16E–03*
Sum of the Fractions						**0.76**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-3 shows the calculation of the sum of the fractions for long-lived radionuclides (Tank WM-182 inventory) using the lowest concentration from either of the Tank WM-183 post-cleaning samples. If only one of the samples events had a detection for a radionuclide, that sample was used in the calculation.

Table F-3. Calculation of the sum of the fractions using Tank WM-183 post-cleaning data (lowest concentration).

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Ci/m3	nCi/g	Class C Concentration Limit (Ci/m3 or nCi/g)	Fraction of Class C Concentration Limit
^{241}Am	432.2	4.10E–01		1.66E+00	1.00E+02	1.66E–02
^{14}C	*5,730*	*2.66E–02*	*2.26E–04*		*8.00E+00*	*2.82E–05*
^{242}Cm	0.446	1.32E–03		5.32E–03	2.00E+04	2.66E–07
^{129}I	*15,700,000*	*7.74E–04*	*6.56E–06*		*8.00E–02*	*8.20E–05*
^{59}Ni	*75,000*	*2.51E–02*	*2.13E–04*		*2.20E+02*	*9.68E–07*
^{94}Nb	*20,300*	*2.06E–01*	*1.74E–03*		*2.00E–01*	*8.71E–03*
^{237}Np	2,140,000	1.25E–02		5.05E–02	1.00E+02	5.05E–04
^{238}Pu	87.75	4.58E+00		1.85E+01	1.00E+02	1.85E–01
^{239}Pu	24,131	3.40E+00		1.37E+01	1.00E+02	1.37E–01
^{240}Pu	6,970	1.35E+00		5.45E+00	1.00E+02	5.45E–02
^{241}Pu	14.4	1.95E+01		7.87E+01	3.50E+03	2.25E–02
^{242}Pu	375,800	9.88E–04		3.99E–03	1.00E+02	3.99E–05
^{99}Tc	*213,000*	*1.36E–01*	*1.15E–03*		*3.00E+00*	*3.85E–04*
Sum of the Fractions						**0.43**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m^3; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-4 shows the sum of the fractions calculations for long-lived radionuclides from the inventory developed using the lowest concentration from any of the samples collected directly from the tanks. These samples include the WM-188, WM-182, and WM-183 samples collected prior to cleaning and samples from WM-183 post-cleaning.

Table F-4. Calculation of the sum of the fractions using lowest concentrations detected in any tank sample.

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Ci/m³	nCi/g	Class C Concentration Limit (Ci/m³ or nCi/g)	Fraction of Class C Concentration Limit
^{241}Am	4.30E+02	1.80E–01		7.40E–01	100	0.0074
^{14}C	*5.70E+03*	2.70E–02	*2.30E–04*		*8*	*0.0000281965*
^{242}Cm	4.50E–01	1.30E–03		5.30E–03	20,000	0.00000027
^{129}I	*1.60E+07*	7.70E–04	*6.60E–06*		*0.08*	*0.000082*
^{59}Ni	*7.50E+04*	2.50E–02	*2.10E–04*		*220*	*0.00000097*
^{94}Nb	*2.00E+04*	2.10E–01	*1.70E–03*		*0.2*	*0.0087*
^{237}Np	2.10E+06	2.00E–03		8.10E–03	100	0.0001
^{238}Pu	8.80E+01	4.50E+00		1.80E+01	100	0.18
^{239}Pu	2.40E+04	4.10E–01		1.70E+00	100	0.017
^{240}Pu	7.00E+03	1.40E+00		5.50E+00	100	0.055
^{241}Pu	1.40E+01	1.90E+01		7.90E+01	3,500	0.022
^{242}Pu	3.80E+05	9.90E–04		4.00E–03	100	0.000040
^{99}Tc	*2.10E+05*	1.40E–01	*1.20E–03*		*3*	*0.0004*
Sum of the Fractions						**0.29**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m³ ; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-5 shows the sum of the fractions calculations for long-lived radionuclides from the inventory developed using the 95% UCL around the mean from any of the samples collected directly from the tanks. These samples include the WM-188, WM-182, and WM-183 samples collected prior to cleaning and samples from WM-183 post-cleaning.

Table F-5. Calculation of the sum of the fractions using 95% UCL of all tank samples.

Radionuclide[a]	Half-Life (yr)	Tank Inventory (Ci)[b]	Tank Inventory Ci/m³	Tank Inventory nCi/g	Class C Concentration Limit (Ci/m³ or nCi/g)	Fraction of Class C Concentration Limit
^{241}Am	432.2	6.70E–01		2.70E+00	100	0.0272
^{14}C	*5,730*	*4.90E–06*	*4.20E–08*		*8*	*0.0000000052*
^{242}Cm	0.446	1.30E–03		5.30E–03	20,000	0.00000027
^{129}I	*15,700,000*	1.00E–03	*8.90E–06*		*0.08*	*0.000111*
^{59}Ni	*75,000*	*2.50E–02*	*2.10E–04*		*220*	*0.00000097*
^{94}Nb	*20,300*	*2.10E–01*	*1.70E–03*		*0.2*	*0.0087*
^{237}Np	2,140,000	9.90E–03		4.00E–02	100	0.0004
^{238}Pu	87.75	1.50E+01		6.00E+01	100	0.60
^{239}Pu	24,131	2.80E+00		1.10E+01	100	0.113
^{240}Pu	6,970	1.40E+00		5.50E+00	100	0.055
^{241}Pu	14.4	1.90E+01		7.90E+01	3,500	0.022
^{242}Pu	375,800	9.90E–04		4.00E–03	100	0.000040
^{99}Tc	*213,000*	*5.60E+00*	*4.80E–02*		*3*	*0.0158*
Sum of the Fractions						**0.84**

a. Radionuclides shown in italics are compared to Class C concentration limits in units of Ci/m³; remaining nuclides are compared to limits in units of nCi/g.

b. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-6 shows the sum of the fractions for the tank vaults using 32.5 m³ of grout. This table is a companion to the sum of the fractions tables in Section 6 of this document.

Table F-6. Calculation of the sum of the fractions for short-lived radionuclides (Table 2 of 10 CFR 61.55) for the tank vault.

Radionuclide	Half-Life (yr)	Tank Inventory (Ci)[a]	Ci/m³	Class C Concentration Limit (Ci/m³)	Fraction of Class C Concentration Limit
^{137}Cs	3.00E+01	1.60E+03	5.10E+01	4,600	0.01103
^{63}Ni	1.00E+02	1.70E–10	5.20E–12	700	7.41E–15
^{90}Sr	2.90E+01	2.50E+02	7.70E+00	7,000	0.001094
Sum of the Fractions					**0.01**

a. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-7 shows the sum of the fractions for the 30,000-gal tanks averaged of the mass and volume of the tank steel. This table is a companion to the sum of the fractions tables in Section 6 of this document.

Table F-7. Calculation of the sum of the fractions for short-lived radionuclides (Table 2 of 10 CFR 61.55) for the 30,000-gal tanks.

Radionuclide	Half-Life (yr)	Tank Inventory (Ci)[a]	Ci/m^3	Class C Concentration Limit (Ci/m^3)	Fraction of Class C Concentration Limit
^{137}Cs	3.00E+01	1.70E+01	1.30E+01	4,600	0.00290
^{63}Ni	1.00E+02	4.30E–02	3.40E–02	700	0.0000479
^{90}Sr	2.90E+01	4.50E–01	3.50E–01	7,000	0.0000502
Sum of the Fractions					**0.002999**

a. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

Table F-8 shows the sum of the fractions for the piping averaged of the mass and volume of the piping steel. This table is a companion to the sum of the fractions tables in Section 6 of this document.

Table F-8. Calculation of the sum of the fractions for short-lived radionuclides (Table 2 of 10 CFR 61.55) for the piping.

Radionuclide	Half-Life (yr)	Tank Inventory (Ci)[a]	Ci/m^3	Class C Concentration Limit (Ci/m^3)	Fraction of Class C Concentration Limit
^{137}Cs	3.00E+01	1.40E+01	6.50E+00	4,600	0.0014
^{63}Ni	1.00E+02	3.60E–02	1.60E–02	700	0.000023
^{90}Sr	2.90E+01	2.90E–01	1.30E–01	7,000	0.000019
Sum of the Fractions					**0.0015**

a. Radioactive decay to 2012; the sum of the fractions will not significantly change if decayed to the present.

References

10 CFR 61, 2004, “Licensing Requirements for Land Disposal of Radioactive Waste,” *Code of Federal Regulations*, Office of the Federal Register, January 1, 2004.

Appendix G

Comparison of Final Waste Form Calculation Methodology to Fundamental Principles on Concentration Averaging in the NRC Draft Interim Guidance

Appendix G

Comparison of Final Waste Form Calculation Methodology to Fundamental Principles on Concentration Averaging in the NRC Draft Interim Guidance

G-1. 300,000-GAL TANKS METHODOLOGY

The methods discussed in the Nuclear Regulatory Commission (NRC) draft interim guidance on concentration averaging (70 Federal Register [FR] 74846) are based on the following fundamental principles:

> *Measures are not to be undertaken to average extreme quantities of* *uncontaminated* *materials with residual waste solely for the purpose of waste classification.* [emphasis added]

The residuals in the Tank Farm Facility (TFF) have not been averaged with extreme quantities of uncontaminated materials solely for the purpose of comparison to Class C concentration limits. The approach for the TFF tanks uses engineered grout placements as a final opportunity for removal of waste and uses a small portion of an encapsulation grout pour to stabilize and encapsulate residuals. This volume of grout is used in the final waste form concentration calculation. This volume represents approximately 8% of the entire tank volume of 1,500 m^3.

> *Mixtures of residual waste and materials can use a volume or mass-based average concentration if it can be demonstrated that the mixture is reasonably well mixed.*

The residual material is well-mixed in the tank prior to grouting due to cleaning activities and the engineered grout placements provide vertical (and some horizontal) mixing in addition to moving some of the residual solids to the steam jet for removal.

The residual waste is considered to be well-mixed and homogeneous relative to the inadvertent intruder scenario. As described in the draft interim guidance, the "technical basis should be provided (e.g., sampling results, engineering experience, operational constraints) to demonstrate that the waste is reasonably well-mixed." Engineering experience gained during the mockup and operational constraints are important components of the ability to demonstrate the residuals are well-mixed.

Because of the repeated mixing during tank washing, the residual solids before adding the engineered grout placements are considered well-mixed. The engineered grout placements are not strictly considered encapsulation activities; however, some waste encapsulation occurs during the grout placement. The engineered grout placements have been primarily designed to provide an opportunity for additional radionuclide removal.

The initial grout placement pushes waste toward the steam jet. The next placements tend to push waste toward the steam jet, yet the grout and residual waste flow up the sides and over the edges of the initial grout placement. As each of the specified placements is made, the vertical mixing of residual waste is increased. The fifth placement, which moves waste around the edges of the tank and toward the steam jet, provides further opportunity for cleaning and, as a secondary effect, increases mixing of residual waste with grout. It may be necessary to include a sixth placement (a division of placement 5 into two separate placements). The placements create an increased mixing height of residual waste with grout in the tank. The mixing of the surrogate waste with the grout during mockup testing is documented by photographic evidence.

Figures G-1 through G-4 show the grout placement mockup and the vertical mixing that occurs between grout placements. The surrogate used for the mockup was kaolin clay; iron oxide was added to give the surrogate a red color. The red color in these and all other photographs indicates contaminated residual. The mixing height was not measured during the mockup because the purpose was to determine the efficacy of the engineered grout placement to enhance removal of residual solids and liquids. A vertical mixing height of approximately 0.8 m or more could be expected based on the observations made during the mockup (INEEL 1999).

Figure G-1 shows the mixing between grout placements. The red material is solid surrogate that has been mixed between the grout placements. The liquids in the mockup were water; therefore, any red-colored materials that are observed are surrogate solids. Figure G-2 shows the mixing between the tank wall and the grout placements. Figure G-3 shows the mounding of the grout placements and the mixing between placements of the surrogate material. A small quantity of liquid is trapped between placements. The quantity of liquid is limited because the placements are introduced sequentially and the placements slope toward the steam jets.

Figure G-4 shows the encapsulation grout pour, which is covering a surrogate that has been forced to the surface of the grout placements. The engineered grout placements remove surrogate, mix the surrogate vertically, and deposit surrogate on the surface of the placements.

> *Credit can be taken for stabilizing materials added for the purpose of immobilizing the waste (not for stabilizing the contaminated structure) even if it can not be demonstrated that the waste and stabilizing materials are reasonably well-mixed, when the radionuclide concentrations are likely to approach uniformity in the context of applicable intruder scenarios.*

An encapsulation grout pour will be completed to stabilize the tank residuals after the engineered grout placement. As previously described, radionuclide concentrations should approach homogeneity in the context of intruder scenarios. The technical basis for the above statement includes sampling results from cleaned tanks and engineering experience gained during mockup.

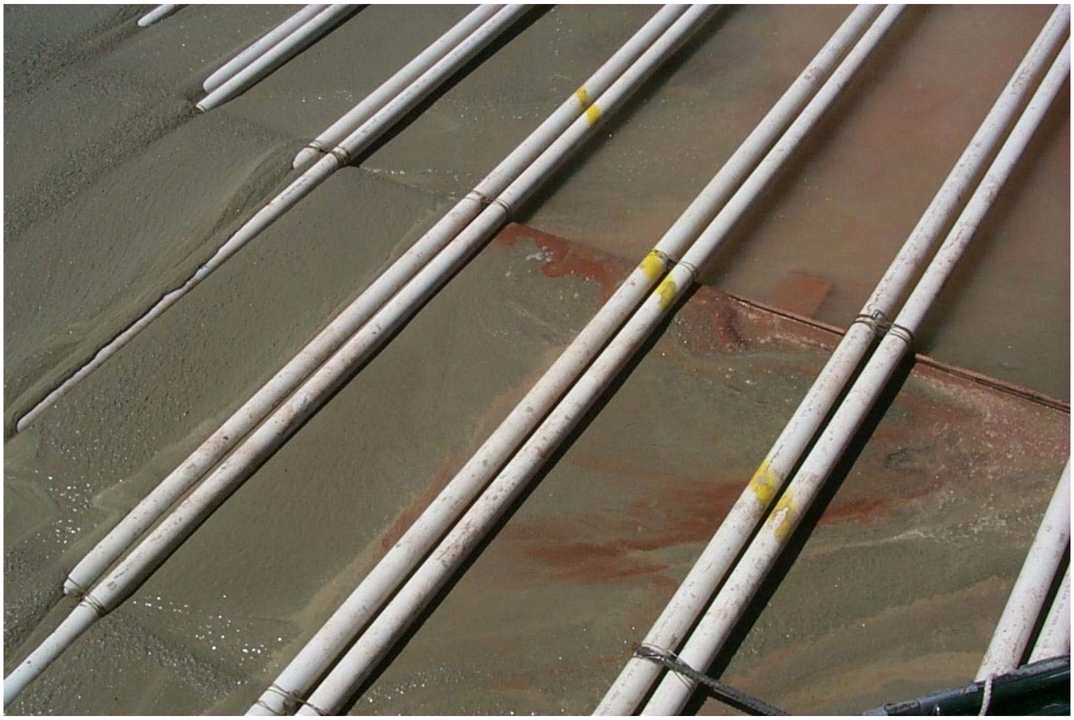

Figure G-1. Vertical mixing during mockup.

Figure G-2. Vertical mixing near the tank wall.

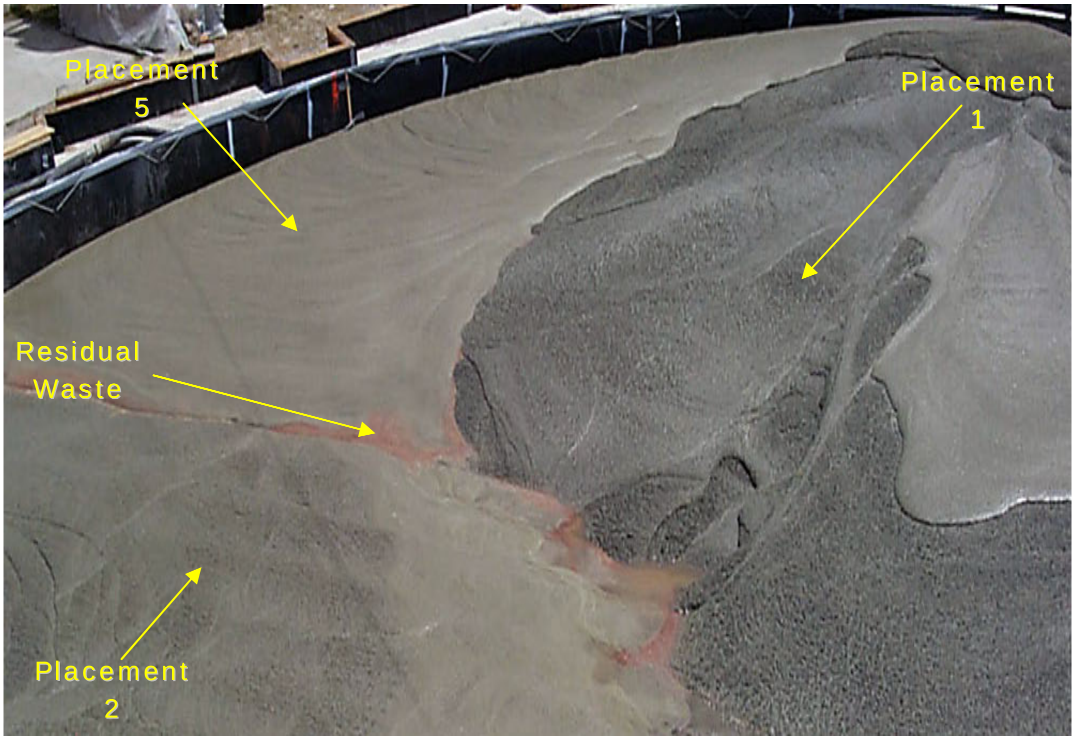

Figure G-3. Mounding of grout placements and vertical mixing.

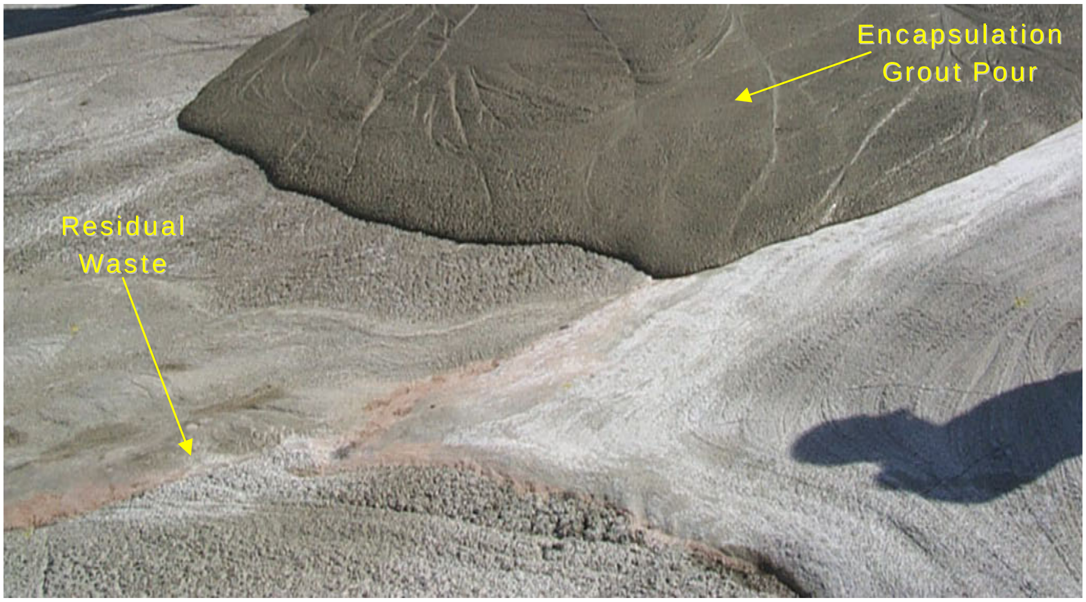

Figure G-4. Encapsulation grout pour covering surrogate that is on the surface.

G-2. 300,000-GAL TANK VAULTS METHODOLOGY

The methods discussed in the NRC draft interim guidance on concentration averaging (70 FR 74846) are based on the following fundamental principles:

> *Measures are not to be undertaken to average extreme quantities of uncontaminated materials with residual waste solely for the purpose of waste classification.*

The residuals in the TFF vaults have not been averaged with extreme quantities of uncontaminated materials solely for the purpose of comparison to Class C concentration limits. Only 32.5 m^3 of grout were used in the calculations, which is approximately 3.5% of the total vault volume of 954 m^3.

> *Credit can be taken for stabilizing materials added for the purpose of immobilizing the waste (not for stabilizing the contaminated structure) even if it can not be demonstrated that the waste and stabilizing materials are reasonably well-mixed, when the radionuclide concentrations are likely to approach uniformity in the context of applicable intruder scenarios.*

A grout pour, as described above, will be used to stabilize the vault residuals. Radionuclide concentrations should approach homogeneity in the context of intruder scenarios. The technical basis for the above statement includes sampling results from cleaned vaults, engineering experience gained during mockup, and operational constraints due to inaccessibility of the sandpads.

G-3. 30,000-GAL TANKS METHODOLOGY

The methods discussed in the NRC draft interim guidance on concentration averaging (70 FR 74846) are based on the following fundamental principles:

> *Measures are not to be undertaken to average extreme quantities of uncontaminated materials with residual waste solely for the purpose of waste classification.*

The residuals in the 30,000-gal tanks have not been averaged with extreme quantities of uncontaminated materials solely for the purpose of comparison to Class C concentration limits. The tank steel is adequate for averaging by mass and volume.

> *Credit can be taken for stabilizing materials added for the purpose of immobilizing the waste (not for stabilizing the contaminated structure) even if it can not be demonstrated that the waste and stabilizing materials are reasonably well-mixed, when the radionuclide concentrations are likely to approach uniformity in the context of applicable intruder scenarios.*

As previously described, a grout pour to stabilize the 30,000-gal tank residuals will be completed. However, this grout pour is not necessary to meet Class C concentration limits. Based on post-cleaning tank inspections, residual contamination was limited to the tank walls. Therefore, the radionuclide concentrations would be assumed to be homogeneous in the context of intruder scenarios.

G-4. PIPING METHODOLOGY

The methods discussed in the NRC draft interim guidance on concentration averaging (70 FR 74846) are based on the following fundamental principles:

> *Measures are not to be undertaken to average extreme quantities of uncontaminated materials with residual waste solely for the purpose of waste classification.*

The residuals in the piping have not been averaged with extreme quantities of uncontaminated materials solely for the purpose of comparison to Class C concentration limits. The piping steel is adequate for averaging by mass and volume.

> *Credit can be taken for stabilizing materials added for the purpose of immobilizing the waste (not for stabilizing the contaminated structure) even if it can not be demonstrated that the waste and stabilizing materials are reasonably well-mixed, when the radionuclide concentrations are likely to approach uniformity in the context of applicable intruder scenarios.*

Grout will be pumped into the piping to stabilize the residuals. However, this grout is not necessary to meet Class C concentration limits.

G-5. REFERENCES

70 FR 74846, Notice: “Draft Interim Concentration Averaging Guidance for Waste Determinations,” Federal Register, U.S. Nuclear Regulatory Commission, December 16, 2005, pp. 74846–74850.

Appendix H

Past NRC Review Recommendations

Appendix H

Past NRC Review Recommendations

The NRC reviewed the PA in consultation with DOE as part of a previous draft waste incidental to reprocessing determination. The NRC staff used the two waste determination criteria provided in the NRC Final West Valley Policy Statement (NRC 2002). The NRC concluded that DOE appeared to have reasonably analyzed the relevant considerations in concluding that the stabilized residuals in the TFF, and the TFF tank system, could meet the two waste determination criteria (NRC 2003) that NRC considered. Specific conclusions reached by the NRC were:

- The U.S. Department of Energy Idaho Operations Office (DOE Idaho) methodology for solid mass estimation and liquid volume estimation is technically adequate

- The conservative source term is likely to bound the residual materials concentrations and quantities actually remaining in the tanks

- The DOE Idaho's argument that key radionuclides will be removed to the extent technically and economically practical is reasonable.

- As indicated by the DOE Idaho PA, combined doses to the public from all pathways are projected to be well below the 25-mrem/yr limit; therefore, staff considers that there is reasonable assurance that safety requirements comparable to 10 CFR 61.41 can be satisfied, including ALARA requirements

- Staff considers that there is reasonable assurance that safety requirements comparable to 10 CFR 61.42 for protection of individuals from inadvertent intrusion can be satisfied

- The worker is protected by DOE regulations that are comparable to 10 CFR 20; therefore, the worker protection performance objective (10 CFR 61.43) can be considered to be met

- The DOE Idaho's plans to fill the tanks, vaults, and ancillary piping with multiple layers of reducing grout appear sufficient to indicate that safety requirements comparable to 10 CFR 61.44 can be met.

Table H-1 presents the NRC's recommendations from its prior review in 2002 for future work and DOE's actions to address the conclusions.

Table H-1. Summary of previous NRC review recommendations (NRC 2003).

Recommendations	DOE Actions
Criterion: The waste should be processed (or should be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical.	
Recommendations	DOE Actions
Sampling of the radiological composition of residual materials remaining in tanks after cleaning should be completed before tank grouting and final closure, in accordance with DOE Idaho's SAP.	Characterization of the tank contents is updated as tanks are cleaned. Tanks WM-180 through WM-186 and WM-103 through WM-106 have been cleaned and sample data have been collected since cleaning began in 2002. The residual waste inventory at closure is significantly lower than estimated in the PA.[a]
Because of the cooperative physical characteristics of the residual materials remaining in the tanks and the relatively small economic impact associated with tank flushing, DOE-Idaho should follow its current plan for cessation of tank flushing only after removal of residual activity from the tank becomes insignificant.	DOE Idaho has followed the recommendation during tank cleaning that tank flushing only be stopped after removal of residual activity from the tanks becomes insignificant. The post-cleaning videos and samples indicate that only a very small amount of residual remains after the cleaning process is completed.
DOE Idaho should stay abreast of tank cleaning technology for potential use in future tank cleaning, if such technology is technically and economically practical.	DOE Idaho continues to stay abreast of tank cleaning technology. However, as noted in this report, tank cleaning has been very successful with the residual inventories being less than the best estimates presented in the PA.[a]
Criterion: The waste should be managed so that safety requirements comparable to the performance objectives in 10 CFR 61, Subpart C are satisfied.	
Recommendations	DOE Actions
If sampling after tank cleaning indicates that the source term is significantly larger than that used in the current PA, then the PA should be reevaluated.	The results of the tank samples after tank cleaning have been used by DOE Idaho to ensure that the source term assumed in the PA is not exceeded. The results of these analyses are documented in engineering design files.[b] To date, all tank samples after cleaning indicate that the residual waste inventory at closure is much less than that assumed in the PA. A methodology to calculate radiation dose based on inventories of cleaned tanks has been developed.[c]

Table H-1. (continued).

Recommendations	DOE Actions
Although this assessment assumed that the conservative sorption coefficients for concrete, basalt, and interbedded sediments were sufficiently bounding, DOE Idaho should consider expanding its literature review or conducting laboratory testing to provide additional confidence for the assertion of conservatism. Currently, the conservative values are simply calculated by interpolation between a lower bound and a realistic case. If retardation of ^{99}Tc in the degraded concrete layer at the base of the tanks provides a significant performance effect, a technical basis should be established for the assumption of reducing conditions in that location.	DOE Idaho has completed an additional sorption coefficient report[d] that compares the sorption coefficients used in the PA against values published in the literature. This additional literature review indicated that the sorption coefficients used in the PA appear to be reasonable.[a] Additional sensitivity analysis has been performed to determine the effect of the vertical location of residual waste in the stabilized tank.[e] As explained in the errata to the PA, the description of the ^{99}Tc vault sorption coefficient was incorrect. In fact, an oxidizing sorption coefficient was used for the vault concrete, while a reducing sorption coefficient was assumed for the grouted waste. Additional, analysis has been performed to understand the transport time to the aquifer and the resulting dose from ^{99}Tc if oxidizing conditions are assumed for the grouted waste in the tanks.
Future PA analyses should evaluate the sensitivity of the results to the use of oxidizing condition distribution coefficients for grout.	Additional analysis has been performed to understand the transport time to the aquifer and the resulting dose from ^{99}Tc if oxidizing conditions are assumed for the grouted waste in the tanks. The results of this analysis indicate the ^{99}Tc tank peak drinking water dose occurs at 842 years at a dose of 0.54 mrem/yr. The total drinking water dose peaks at 874 years due to the combined doses from ^{99}Tc and ^{129}I. The drinking water dose contributions from ^{99}Tc and ^{129}I to the total drinking water dose at this time are 0.54 and 0.76 mrem/yr, respectively.[f]
DOE Idaho should evaluate, and if needed, enhance QA controls of documentation in future PAs as the TFF closure progresses.	DOE is committed to QA. To enhance QA, more thorough internal and independent reviews have been conducted on the PA and associated documentation. Internal reviews have been performed on this document.
As cleaning and closure of tanks progress, the closure strategy for each tank should be refined based on information obtained from prior tank and ancillary equipment closures at the TFF.	The closure strategy for each tank has continually been updated from lessons learned from prior tank cleanings and ancillary equipment closures. The cleaning and closure method has been refined such that efficiencies in removal of the residual tank inventories are being obtained.

Table H-1. (continued).

Recommendations	DOE Actions
DOE Idaho should investigate methods for measuring or better estimating the contaminated sandpad radionuclide inventories.	DOE has considered alternative options to collect sandpad samples; however, no sampling method either by direct or indirect means has been found, which is either practical or would provide data of known quality. DOE has evaluated options such as flushing the vault and collecting samples of flush water. It has been concluded that this option would not provide an improved estimate of sandpad source term. Contamination from the sandpad is not distinguishable from other sources of contamination from the vaults. DOE has developed a bounding inventory for the sandpad in the PA. The sandpads are located beneath the tanks, making sampling difficult to impossible. The sandpad inventory is considered by DOE Idaho to bound the real contamination potential. Several vault flooding events from melting snow have not been considered in the final sandpad inventory calculations, which would reduce the sandpad inventory.

a. DOE-ID 2003.
b. Portage 2005a, 2005b, 2005c, 2005d, 2005e, 2005f, 2006.
c. Portage 2005g.
d. Portage 2005h.
e. Portage 2005i.
f. Portage 2005j.

References

DOE-ID, 2003, *Performance Assessment for the Tank Farm Facility at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10966, Rev. 1, April 2003 (Errata December 2, 2003).

NRC, 2003, "NRC Review of Idaho National Engineering and Environmental Laboratory Draft Incidental Waste (Waste-Incidental-to-Reprocessing) Determination for Tank Farm Facility Closure," SECY-03-0079, Nuclear Regulatory Commission, May 15, 2003.

Portage, 2005a, "WM-180 Tank Solid and Liquid Volume Estimates and Post-Decontamination Radionuclide Inventories," PEI-EDF-1019, Rev. 1, Portage, Inc., Idaho Falls, Idaho, August 31, 2005.

Portage, 2005b, "WM-182 Tank Solid and Liquid Volume Estimates and Post-Decontamination Radionuclide Inventories with Comparisons to Performance Assessment Modeling Results," PEI-EDF-1009, Rev. 2, Portage, Inc., Idaho Falls, Idaho, August 31, 2005.

Portage, 2005c, "WM-183 Tank Solid and Liquid Volume Estimates and Post-Decontamination Radionuclide Inventories with Comparisons to Performance Assessment Modeling Results," PEI-EDF-1010, Rev. 3, Portage, Inc., Idaho Falls, Idaho, December 22, 2005.

Portage, 2005d, "WM-184 Tank Solid and Liquid Volume Estimates and Post-Decontamination Radionuclide Inventories with Comparisons to Performance Assessment Modeling Results," PEI-EDF-1011, Rev. 2, Portage, Inc., Idaho Falls, Idaho, August 31, 2005.

Portage, 2005e, "WM-185 Tank Solid and Liquid Volume Estimates and Post-Decontamination Radionuclide Inventories with Comparisons to Performance Assessment Modeling Results," PEI-EDF-1012, Rev. 2, Portage, Inc., Idaho Falls, Idaho, August 31, 2005.

Portage, 2005f, "WM-186 Tank Solid and Liquid Volume Estimates and Post-Decontamination Radionuclide Inventories with Comparisons to Performance Assessment Modeling Results," PEI-EDF-1013, Rev. 2, Portage, Inc., Idaho Falls, Idaho, August 31, 2005.

Portage, 2005g, "Methodology for Evaluating Tank Sample Data and Evaluating Compliance with Performance Assessment Results," PEI-EDF-1021, Rev. 0, Portage, Inc., Idaho Falls, Idaho, August 2005.

Portage, 2005h, "Analysis of Sorption Coefficient (K_d) Values Supplemental Report for the Tank Farm Facility Preliminary Assessment," PEI-EDF-1023, Rev. 0, Portage, Inc., Idaho Falls, Idaho, August 2005.

Portage, 2005i, "Sensitivity of Radionuclide Residual Waste Location in a Grouted Tank at the Tank Farm Facility," PEI-EDF-1022, Rev. 0, Portage, Inc., Idaho Falls, Idaho, August 2005.

Portage, 2005j, "Evaluation of ^{99}Tc Drinking Water Dose for Oxidizing Sorption Coefficient in the Tank Grout," PEI-EDF-1024, Rev. 0, Portage, Inc., Idaho Falls, Idaho, August 2005.

Appendix I

Management Control Systems

Appendix I

Management Control Systems

This appendix summarizes the management control systems applicable to the Tank Farm Facility (TFF) Section 3116 Determination process. They are designed to ensure that both primary project objectives are met and an optimum margin of safety for protection of personnel, the public, and the environment are achieved. The management controls implemented by the field managers for these elements ensure that the Section 3116 Determination criteria are met for disposal of the residual waste and TFF tank system at the Idaho National Laboratory (INL) Site. The following elements are addressed:

- Procedures
- Quality assurance (QA)
- Document and record control
- Training and qualifications.

I-1. PROCEDURES

This document was developed using formal processes and methods. Existing INL Site policies, programs, and procedures were used to manage and implement many of the INL Site activities that support the Section 3116 Determination process. Implementing documents and procedures were also used for tank inventory sampling, data collection, analyses, and other activities performed in support of the Section 3116 Determination process. This subsection discusses the key documents used for the management and performance of the Section 3116 Determination activities.

The INL Site Document Management Control System presents written instructions for preparing, reviewing, approving, maintaining, and distributing documents and changes to documents. The Document Management Control System applies to controlled documents. The system was developed to prescribe processes, specify requirements, and establish design as it relates to TFF closure activities, including development of this document.

The *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* (DOE-ID 2005) defines U.S. Department of Energy Idaho Operations Office (DOE Idaho) requirements for characterizing, packaging, and documenting reusable property, recyclable materials, and waste to be received by the INL Site. The scope of the waste acceptance criteria (WAC) includes requirements applicable to the following radioactive waste classifications: low-level waste, transuranic waste, and high-level waste. The WAC also specifies requirements for identifying and managing hazardous and nonhazardous wastes under the Hazardous Waste Management Act (State of Idaho 1983)/Resource Conservation and Recovery Act (42 United States Code [USC] 6901 et seq., 1976). The WAC requires that each generator of radioactive waste provides assurance that appropriate sections of the acceptance criteria and applicable requirements are met.

Management control procedures (MCPs) are controlled implementing documents that prescribe administrative processes to be performed to support TFF closure and development of this document. Specific implementing documents that pertain to TFF closure and this document are listed in QA program requirements documents listed in the *Quality and Requirements Management Program Documents*

(INL 2005). The INL Site implementing procedures and documents prescribe how work is to be performed.

I-2. QUALITY ASSURANCE

The U.S. Department of Energy (DOE) and its contractors shall develop and maintain a QA program for radioactive waste management facilities, operations, and activities that meet the requirements of 10 Code of Federal Regulations (CFR) 830, Subpart A, "Quality Assurance Requirements," and DOE Order 414.1C, "Quality Assurance" (2005), as applicable.

This document was developed under a QA program that ensures the validity of the information used to make the determination. This subsection describes the QA programs applicable to this document to ensure compliance with the *Quality and Requirements Management Program Documents* (INL 2005). Figure I-1 illustrates the relationship of the various QA programs and documents discussed below.

The DOE Idaho establishes QA requirements for the INL Site management and operating (M&O) contractor through the INL M&O contract with CH2M-WG Idaho, LLC (CWI). The INL Site M&O *Quality and Requirements Management Program Documents* describe CWI's QA program and are based on DOE Order 414.1C, "Quality Assurance" (2005), and 10 CFR 830, Subpart A, "Quality Assurance Requirements." The *Quality and Requirements Management Program Documents* apply to M&O organizations responsible for achieving, maintaining, and verifying the quality of items and activities in support of facilities, programs, and projects; and to companies performing work for CWI, as specified in procurement contracts.

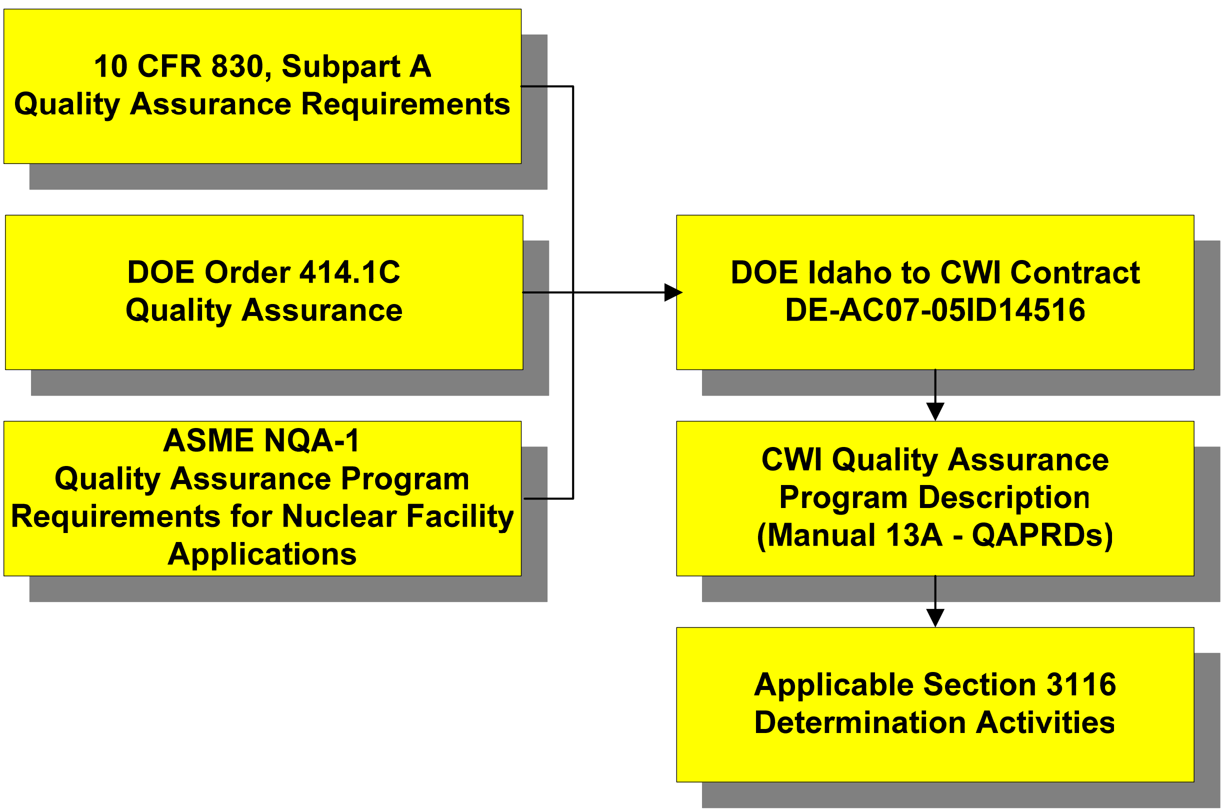

Figure I-1. Quality assurance program hierarchy.

Table I-1 identifies the specific American Society of Mechanical Engineers (ASME) NQA-1 (ASME 1997) elements that CWI has determined are applicable to the waste process. The waste process QA requirements will be evaluated against the WAC to ensure that QA program requirements are met for waste storage, transportation, and disposal.

Details for implementing the 10 NQA-1 elements listed in Table I-1 can be found in the "Quality Program Plan for the High-Level Waste Program Office" (PLN-627, 2002). This plan describes the QA program for high-level waste activities managed by the INL Site, including TFF closure and Section 3116 Determination activities. The CWI implements its QA program using a graded approach. The graded approach incorporates safety categories that identify the relative importance of an item or activity to the consequence of failure, should failure of the item or activity occur. The MCPs are used to facilitate implementation of the graded approach and the assignment of quality levels to structures, systems, and components and activities.

I-3. DOCUMENT AND RECORD CONTROL

Records management systems ensure that records important to safety and quality are generated, reviewed, approved, collected, and maintained. The management system provides controls so that records accurately reflect completed work and facility conditions and comply with applicable statutory or contractual requirements.

The INL Site MCPs incorporate the requirements of DOE Order 200.1, "Information Management Program" (1996), and DOE Order 414.1C, "Quality Assurance" (2005). Schedules for records retention and disposition are in accordance with the General Records Schedule of the National Archives and Records Administration and other approved records schedules. The MCPs include instructions for retention, protection, preservation, changes, traceability, accountability, and retrievability of records. They also provide controls to ensure records are legible, accurate, complete, retrievable, and validated by authorized personnel.

Records are stored and maintained to minimize the risk of damage, larceny, vandalism, or deterioration. Active records are not sent to records holding facilities but are stored in a facility where the records may be readily accessed.

Table I-1. ASME NQA-1 applicability (ASME 1997).

ASME NQA-1 1997 Element Number	Description
1	Organization
2	Quality Assurance Program
3	Design Control
4	Procurement Document Control
5	Instructions, Procedures, & Drawings
6	Document Control
7	Control of Purchase Items and Services
16	Corrective Action
17	Quality Assurance Records
18	Audits

I-4. TRAINING AND QUALIFICATIONS

The INL Site training program focuses on providing employees with the knowledge and skills necessary to perform tasks that meet acceptance criteria. The INL Site training, with the assistance of subject-matter experts, is responsible for analyzing, designing, developing, implementing, and evaluating training programs and processes. The MCPs detail the instructional processes used, including self-study, computer, and video-based training, instructor-led training, and on-the-job training.

The DOE Idaho and CWI define training and qualification requirements for selected positions or job categories by considering the level of knowledge and skills required to perform tasks. Training plans are developed to guide development of skills and knowledge necessary for employees to meet requirements of specific job categories. Training and qualification requirements are established and periodically reviewed to ensure that requirements continue to reflect training needs.

The INL Site MCPs incorporate the requirements of DOE Order 5480.20A, "Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities" (1994). The MCPs describe personnel selection requirements and training, qualification, certification, and continued training processes. Procedures specify the frequency for which training is needed. The DOE Idaho and CWI determine and document when personnel are suitably qualified to accomplish assigned tasks.

Personnel that perform 3116 Basis Document development, review, approval, and revision functions receive training in the applicable scope, purpose, and objectives of the 3116 Basis Document process and the specific QA objectives of the assigned task before performing 3116 Basis Document process activities. Personnel also receive training on applicable implementing procedures used in the performance of the task.

This training includes appropriate subject material from the following documents:

- DOE Order 435.1, "Radioactive Waste Management" (2001)
- DOE Manual 435.1-1, "Radioactive Waste Management Manual" (2001)
- DOE Guidance 435.1-1, "Implementation Guide for use with DOE M 435.1-1" (1999)
- 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Subpart C, "Performance Objectives," and Subpart D, "Technical Requirements for Land Disposal Facilities," 61.55, "Waste Classification"
- *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* (DOE-ID 2005)
- QA program requirements documents listed in the *Quality and Requirements Management Program Documents* (INL 2005).

Training is documented and training records are maintained in accordance with INL Site MCPs. Qualifications of CWI personnel supporting the 3116 Basis Document development process are documented, and appropriate records are maintained. Subcontractors supporting tank closure and 3116 Basis Document activities are selected based on company and personnel qualifications and experience. All training records are available for review.

I-5. QUALITY ASSURANCE FOR DATA COLLECTION

Quality assurance can be defined as an integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service is the type and quality needed and expected by the customer (EPA 2006a). This quality system, according to the U.S. Environmental Protection Agency (EPA 2006a), can be viewed as having three tiered levels of hierarchy: policy, organization or program, and project. Policy, the highest level, is comprised of the mandated regulatory drivers that must be addressed. The middle level, organization or program, addresses the management and implementation component of the individual quality system. And finally, at the bottom level, are the project-specific components that are applied to ensure that the needs of the organization are met. The TFF closure project used the data quality objective (DQO) and data quality assessment (DQA) process during all phases of data collection and assessment.

At the project level, three stages define the project's life cycle: planning, implementation, and assessment. Systematic planning, the first key component to QA, is based on a common sense, graded approach to ensure that the level of detail in planning is commensurate with the importance and intended use of the work and the available resources. An effective approach to plan data collection efforts, to establish acceptance criteria for the quality of data collected, and to develop an appropriate data collection design to support decision-making is the DQO process.

I-5.1 The Data Quality Objective Process

The DQO process helps to focus studies, to clarify vague objectives, and to limit the number of decisions that will be made. The DQO process breaks the planning approach to develop sampling designs for data collection activities that support decision-making into seven steps.

1. State the Problem: Define the problem, identify the planning team, and examine budget and schedule.

2. Identify the Decision: State decision, identify study question, and define alternative actions.

3. Identify the Inputs to the Decision: Identify information needed for the decision (information sources, basis for action level, sampling and analysis method).

4. Define the Boundaries of the Study: Specify sample characteristic, define spatial or temporal limits, and establish units of decision-making.

5. Develop a Decision Rule: Define statistical parameter (e.g., mean, median), specify action level, and develop logic for action.

6. Specify Tolerable Limits on Decision Error: Set acceptable limits for decision errors relative to the consequences (e.g., health effects, costs).

7. Optimize the Design for Obtaining Data: Select resource-effective sampling and analysis plan that meets the performance criteria.

The DQO process is intended to be both flexible and iterative, allowing the planning team (senior program staff, technical experts, managers, data users, regulators, and stakeholders) to incorporate new information and to incorporate outputs from previous steps into subsequent planning processes. The DQO process is best suited to problems that require making a decision between two clear alternatives. The final outcome is a design for collecting data (such as the number of samples to collect, when, where, and how to collect samples) and the limits on the probabilities of making decision errors.

The DQOs are defined as both qualitative and quantitative statements that clarify study objectives, define the appropriate type(s) of data to be collected, and specify tolerable levels of potential decision errors. They form the basis for establishing the quality and quantity of data needed to support decisions and the performance criteria that limit the probabilities of decision errors.

The first five steps in the DQO process are primarily focused on identifying quality criteria (e.g., the nature of the problem that has initiated the study) a conceptual model of the environmental hazard to be investigated, the decisions that need to be made and the order of priority for resolving them, the type of data needed (i.e., geographic area, environmental medium, overall timing of data collection, etc.), and a decision rule (a theoretical "*If…then…*" statement) defining how the data will be used to choose among alternative actions.

The sixth step defines quantitative criteria, expressed as limits on the probability or risk of making a decision error that the decision-maker can tolerate. A decision error occurs when the sample data set misleads the decision-maker into the wrong decision and wrong response action. For example, declaring a site contaminated and requiring further remediation when, in fact, the clean-up activities have been successful.

The seventh step is used to develop a data collection strategy based on the criteria developed in the first six steps. The outputs of the DQO process are used to perform a DQA.

I-5.2 Data Quality Assessment

Data quality assessment is a statistical and scientific evaluation of the data set used to determine the adequacy of the data set for its intended use. In general, the DQA provides a scientific and statistical evaluation of data to determine if acquired data are of the right type, quality, and quantity to support their intended use. The DQA process is designed around the key idea that data quality, as a concept, is only meaningful when it directly relates to the intended use of the data (EPA 2006b). Two primary questions can be answered using the DQA process:

1. Does the quality of the data permit decisions to be made with the desired degree of confidence?

2. How well can the sampling design be expected to perform over a wide range of possible outcomes? That is, can the sampling design strategy be expected to perform well in a similar study with the same degree of confidence even if the actual measurements are different than those obtained in the present study?

The first question addresses the immediate needs of the study. If the assessment shows the data are of sufficient quality, it allows for sound decision-making (i.e., unambiguous data allows for decisions with the desired level of confidence as specified during data acquistion planning). Conversely, if the data do not provide sufficiently strong evidence to support one decision over another, then appropriate data analysis can alert the decision-maker to the degree of ambiguity in the data. If this is the case, an informed decision can be made about how to proceed. For example, based on the data obtained, more data may be collected or the decision-maker may make a decision knowing there is a greater-than-desired uncertainty in the decision.

The second question addressed by the DQA process is possible future applications of the study. After the DQA is completed, a determination is made as to how well the sampling design may perform at a different location given the different environmental conditions and outcomes that likely occur at the other location. Because environmental conditions vary from location to location, it is important to examine the sampling design over a large range of possible settings to ensure it will be adequate for other scenarios.

Data quality assessment consists of both data validation and analysis of the validated data set. Data validation is employed to ensure all sampling and analysis protocols were followed properly. Data analysis is performed to the level of confidence decision-makers can place in the data set. The DQA process is comprised of the following five steps:

1. Review the DQOs and sampling design

2. Conduct a preliminary data review

3. Select a statistical test

4. Verify the assumptions of the selected test

5. Draw conclusions from the data.

The DQA process is intended to be an iterative process that promotes an understanding of how well the data satisfy their intended use. It is completed by progressing in a logical and efficient manner. It is important to note that because data collection provides an estimate of the value of interest (a decision-maker can never know the true value of the item of interest), the DQA cannot absolutely prove that the DQOs set forth in the planning phase have been achieved. Rather, the DQA evaluates the risk of making a wrong decision about the item of interest. Ultimately, the DQA process provides the decision-maker with a quantitative means of evaluating these risks and a means to progress to the next phase of the program.

I-6. REFERENCES

10 CFR 61, 2004, “Licensing Requirements for Land Disposal of Radioactive Waste,” *Code of Federal Regulations*, Office of the Federal Register, January 1, 2004.

10 CFR 830, Subpart A, 2004, “Quality Assurance Requirements,” *Code of Federal Regulations*, Office of the Federal Register, January 1, 2004.

42 USC 6901 et seq., 1976, “Resource Conservation and Recovery Act of 1976, as amended.”

ASME, 1997, “Quality Assurance Requirements for Nuclear Facility Applications,” NQA-1, American Society of Mechanical Engineers, December 1997.

DOE G 435.1-1, 1999, “Implementation Guide for Use with DOE M-435.1-1,” U.S. Department of Energy, July 9, 1999.

DOE M 435.1-1, 2001, “Radioactive Waste Management Manual,” U.S. Department of Energy, June 19, 2001.

DOE O 200.1, 1996, “Information Management Program,” U.S. Department of Energy, September 30, 1996.

DOE O 414.1C, 2005, “Quality Assurance,” U.S. Department of Energy, June 17, 2005.

DOE O 435.1, 2001, “Radioactive Waste Management,” Change 1, U.S. Department of Energy, August 28, 2001.

DOE Order 5480.20A, “Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities” Change 1, U.S. Department of Energy, July 12, 2001.

DOE-ID, 2005, *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria*, DOE/ID-10381, Rev. 21, January 2005.

EPA, 2006a, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C., February 2006.

EPA, 2006b, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, EPA/240/B-06/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington D.C., February 2006.

INL, 2005, *Companywide Manual 13A—Quality and Requirements Management Program Documents*, Rev. 50, Idaho National Laboratory, February 1, 2005.

PLN-627, 2002, “Quality Program Plan for the High Level Waste Program Office,” Rev. 1, High-Level Waste Program, April 8, 2002.

State of Idaho, 1983, “Hazardous Waste Management,” Idaho Statute, Title 39, “Health and Safety,” Chapter 44, “Hazardous Waste Management” (also known as the Hazardous Waste Management Act of 1983).